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SEVERIN (H. H. P.) & FREITAG (J. H.). **Western Celery mosaic.**—*Hilgardia*, xi, 9, pp. 493–558, 8 pl., 9 figs., 1938.

Celery in California is affected by western celery mosaic [*R.A.M.*, xv, p. 191; xviii, pp. 78, 83], celery calico [ibid., xv, p. 191], celery yellow spot, celery crinkle leaf, celery yellows (identical with California aster yellows) [ibid., ix, p. 289], and [tomato] spotted wilt, and has also been experimentally infected by sugar beet curly top and ring spot of poison hemlock [*Conium maculatum*]. Crinkle leaf is characterized by crinkled leaflets with green islands or blister-like elevations, stunting of the young plants, and yellowing of the leaves, frequently followed by death. Yellow spot is proposed as a name for a disease causing small, irregular chlorotic areas on the leaves, yellow stripes along the veins, and frequently white spots on the petioles.

Investigations into western celery mosaic showed that the host range is confined to the Umbelliferae. Varieties of celeriac and carrot were found to be naturally infected, while experimental infections by juice inoculations and by means of aphids gave positive results on Large Smooth Prague celeriac, dill (*Anethum graveolens*), curled chervil (*Anthriscus cerefolium*), caraway (*Carum carvi*), coriander (*Coriandrum sativum*), carrots, and single or plain parsley.

Mechanical inoculations of healthy celery with juice from the leaves of infected carrots gave lower percentages of infection than with juice from the roots. The virus was more readily recovered from parsley by mechanical inoculation (42·9 per cent.) than by *Aphis ferruginea-striata* (5·7 per cent.), these transmissions being secured from parsley plants devoid of symptoms. Mechanical inoculations of cucumber plants with the extract from affected celery collected in 23 localities gave negative results, as did attempts at similar transmission with 11 species of aphids.

The virus is filterable through all grades of Chamberland filters. Its thermal inactivation point is 60° C. in 10-minute exposures, its tolerance to dilution 1 in 4,000, and its resistance to ageing *in vitro* 7 days; the virus in the supernatant liquid withstood treatment with 30 per cent. alcohol for one hour and that in the precipitate 40 per cent. The incubation period is 10 to 16 days or more out-of-doors.

The chief symptoms on small plants in the field are yellowing of the foliage, plant stunting, shortening of the central younger petioles, and

while normally the nuclear and cell divisions preceding the elongation of an internode primordium occur first on one side of the growth cone and then on the other, the formation of short or double nodes is preceded by nuclear and cell divisions simultaneously on both sides of the cone. It is finally stated that the results of further experiments clearly indicated that the boron deficiency symptoms described by Maier [ibid., xvi, p. 585] are quite distinct from those of court-noué.

KACZMAREK (A.). **Untersuchungen über den Rückgang von Pfropfreben in Neuanlagen des Saale- und Unstrutgebietes.** [Investigations on the dying-out of grafted Vines in new plantations of the Saale and Unstrut region.]—*Gartenbauwiss.*, xii, 4–5, pp. 420–509, 16 figs., 4 diags., 1 graph, 1939.

This is a full account of investigations started in 1928 to ascertain the causes of the high mortality of grafted vines in newly planted vineyards in the Saale and Unstrut region of Germany, which aroused considerable apprehension among the local growers from 1925 to 1930, and is still prevalent in some localities. The results are claimed to have shown conclusively that the trouble is not of parasitic or virus origin. All the evidence collected indicated that it is mainly due to unfavourable environmental, especially soil, conditions, and possibly also to some extent to defective grafting and neglect of the cuttings prior to planting in the field.

FOËX (E.) & CRÉPIN (C.). **Sur quelques maladies et accidents des plantes cultivées en 1938.** [On some diseases and injuries of cultivated plants in 1938.]—*C.R. Acad. Agric. Fr.*, xxv, 3, pp. 131–137, 1939.

During 1938 *Cercosporella herpotrichoides* was more in evidence than *Ophiobolus graminis* as an agent of foot rot in wheat in France [*R.A.M.*, xviii, p. 166], where the authors' observations in Seine-et-Oise and Loiret were confirmed by those of E. Rosella in the eastern Pyrenees. *Fusarium culmorum* was unusually virulent on oats [ibid., xvii, p. 668], causing bleaching and desiccation of the panicles and premature death of the plants. In the plain of Saône and the Rhone Valley cereal crops were severely damaged by the night frosts of April, and in some cases the stem lesions bore an apparently parasitic *Sclerotium*, the symptoms associated with which resembled those described for *S. costantini* [on wheat: ibid., xvi, p. 734].

Potatoes suffered from a characteristic physiological disorder known as 'boulage' [failure], apparently associated with excessive dryness of the soil and resulting in the development of a succession of minute, unmarketable tubers, which give rise to feeble shoots incapable of producing a normal crop. *Rhizoctonia* [*Corticium*] *solani* flourished on potatoes during the dry, cold months of April and May, but Bintjes in one district under observation made a good recovery following heavy rains in early June.

DASTUR (J. F.). **Report of the Mycologist, Central Provinces and Berar, for the year ending the 31st March, 1938.**—*Rep. Dep. Agric. Cent. Prov. Berar, 1938*, pp. 30–32, 1939.

Cotton seed treated before sowing on the Nagpur College Farm with

agrosan G, hortosan B, abavit B, ceresan, copper carbonate, sulphur, or sulphuric acid gave higher yields than the untreated controls. Anthracnose [*Glomerella gossypii*] caused severe infection of cotton in parts of Berar [*R.A.M.*, xvi, p. 232] owing to the high humidity prevailing in October; the Buri and Roseum varieties were virtually free from the disease, but Bani 306, Verum 438, and especially Verum 434 sustained heavy damage.

Head smut of sorghum (*Sorosporium reilianum*) [ibid., xvi, p. 377] was experimentally shown to be a soil-borne disease. Soil in pots inoculated with the fungus a week or a fortnight before sowing gave rise to a higher percentage of smutted plants than that infected at sowing time. Attempts to infect the plants through the growing point or lateral 'eyes' gave negative results. Young sorghum plants were successfully inoculated with *Sphacelotheca sorghi* [loc. cit.] by placing the spores on the growing points or introducing the inoculum into the stem below the growing point by means of a hypodermic syringe.

'Tikka' disease of groundnuts [*Cercospora personata*: ibid., xvi, p. 232] developed late and caused little damage, but much higher yields were obtained from plots sprayed with Bordeaux mixture (especially with linseed oil as a sticker) than in those left untreated.

Mottling or frenching of oranges [ibid., xiv, p. 481] was reported from various localities.

Brown spot of tobacco (*Alternaria longipes*) [ibid., xvii, p. 776] was observed at Ellichpur and Bilaspur.

NOBLE (R. J.). **Australia: notes on plant diseases recorded in New South Wales for the year ending 30th June, 1938.**—*Int. Bull. Pl. Prot.*, xiii, 2, pp. 25–26, 1939.

Flag smut (*Urocystis tritici*), though still serious on susceptible wheat varieties, is stated to be of less importance than formerly in New South Wales [*R.A.M.*, xiv, p. 25], as resistant varieties are now very widely grown there. Potatoes in coastal areas were affected by brown rot (*Bacterium solanacearum*) and the tomato spotted wilt virus [ibid., xvii, p. 223]; the most common virus disease of this crop locally is leaf roll. Bananas developed a 'rubbery' condition, in which their texture was hard and unpalatable, apparently associated with production in forest areas and low temperatures in the later stages of development. Iceland poppies (*Papaver nudicaule*) were affected by crown rot (*Phytophthora cryptogea*), and violets by scab (*Sphaceloma violae*) [ibid., xiv, p. 764].

STOREY (H. H.). **Plant pathology.**—*Rep. E. Afr. agric. Res. Sta., 1st April–31st December, 1937*, pp. 9–13, 1938.

In connexion with breeding work against cassava virus diseases in East Africa the author states that Amani is very suitable for the maintenance of the large number of cassava types now collected, as the infection rate is low and mosaic [*R.A.M.*, xviii, p. 230] is readily controllable by roguing. A testing ground, however, will have to be developed elsewhere. The existence, now confirmed, of different strains of the mosaic virus [loc. cit.] may greatly increase the difficulties of control. Under favourable conditions, the brown streak cassava virus [ibid.,

xvi, p. 87] causes a total loss of the crop, but such conditions are unusual in the areas where the crop is grown, and severe loss has occurred so far only in Amani during the colder months. The disease, however, appears to be as prevalent as mosaic in Zanzibar and the Tanganyika coastal belt, and it certainly plays a part in crop degeneration. It destroys many of the buds, and diseased cuttings frequently fail to shoot.

Arrangements have been made for the spectrographic analysis of clove material, to determine the cause of 'sudden death' [ibid., xvii, p. 626].

ORIAN (G.). **Division of Plant Pathology.**—*Rep. Dep. Agric. Mauritius, 1937*, pp. 35–39, 1939.

Inoculations into sugar-cane leaves and blades with a bacterium isolated from diseased *Thysanolaena maxima* [*T. agrostis* Nees: *R.A.M.*, xvii, p. 67] showed this organism to be identical with *Bacterium vasculorum*. Cross-inoculations with *Bact. vasculorum* and the bacteria from white palm (*Dictyosperma album*) [ibid., xvi, p. 745] and *T. agrostis* on their several hosts and maize further confirmed their identity. In view of the cultural characters of the maize bacterium and of the similarity of the symptoms shown in the bacterial disease of maize reported from Mauritius in 1932 [ibid., xiii, p. 495] and those produced by *Bact. vasculorum* when inoculated into maize, it is now considered that the maize disease recorded in 1932 was also due to *Bact. vasculorum*. Inoculations with isolations from sugar-cane, *D. album*, and *T. agrostis* gave positive results on *Coix lacryma-jobi*, *Panicum maximum*, and a species of giant bamboo (*Dendrocalamus* sp.); the organism was reisolated from the stripes produced on the leaves of the inoculated plants.

In further trials of the resistance of sugar-cane varieties to *Bact. albilineans* [ibid., xvii, p. 97] it was found that D.K. 74, practically immune under field conditions, again showed marked susceptibility to artificial infection through the cuttings, five out of seven stools inoculated showing the disease during the first year of growth.

Tobacco in one field showed symptoms possibly due to potash deficiency [ibid., xvi, p. 412]. In the top leaves the veins were much thickened, and the interveinal tissue was chlorotic or almost white. These leaves were very dwarfed, and the tips curved down. The condition was not transmitted by grafting, and the affected plants recovered when transferred to new soil.

JOHNSTON (C. O.) & BROOKS (T. E.). **Kansas mycological notes, 1937.**—*Trans. Kans. Acad. Sci.*, xli, pp. 121–123, 1938.

The 1937 epidemic of stem rust of wheat [*Puccinia graminis tritici*] is stated to have been one of the most serious ever experienced in Kansas, causing an average loss over the State of 6·6 per cent., representing a reduction in yield of over 10,000,000 bush. Infection appeared in the counties along the Oklahoma line about 20th May and travelled northwards, developing with extreme severity (27 per cent. average loss) in the eastern counties. Other observations on cereal rusts included heavy infection of sweet corn [maize] and teosinte (*Euchlaena mexicana*) by *P. sorghi* [*P. maydis*]. Sorghum rust (*P. purpurea*)

[*R.A.M.*, xv, pp. 635, 683] was detected near Manhattan for the first time for several years. In the same district lucerne rust (*Uromyces striatus*) [ibid., xvii, p. 325] was also prevalent.

*Gnomonia ulmea* [ibid., xviii, p. 354] was widespread on American elm [*Ulmus americana*] foliage in the east of the State, but caused little damage to the red [*U. rubra* or *U. fulva*] and Chinese [*U. pumila*] species. *Tranzschelia* [*P.*] *pruni-spinosae* was responsible for exceptionally heavy infection of wild black cherry (*Prunus serotina*) [ibid., xviii, p. 322] in a soil-conservation nursery.

**Department of Plant Pathology. Plant disease studies.**—*Rep. Okla. agric. Exp. Sta., 1936–38*, pp. 135–144, 1939.

During 1938 a destructive outbreak of orange leaf [brown] rust [*Puccinia triticina*] occurred on wheat in Oklahoma. Evidence was obtained that infection of the new crop in the autumn of 1938 was mainly due to spores blown into Oklahoma from the north, and not to spores borne on local stands of volunteer wheat or grasses. Thus the practice, usually recommended for control purposes, of destroying volunteer grain in the fence rows would appear to be of small value. Control must finally depend on the use of resistant varieties.

In experiments with Turkey wheat in 1937–8 grading into small and large seed fractions materially reduced the amount of bunt [*Tilletia caries* and *T. foetens*] in the seed and increased the stand. Infection in the untreated controls amounted to about the average for Oklahoma, and was completely eliminated by seed dusting with ceresan ($\frac{1}{2}$ oz. per bush.) or copper carbonate ($2\frac{1}{2}$ oz. per bush.). Mechanical dusting gave more effective control than stirring the dust into the seed by hand in the drill box.

Laboratory, greenhouse, and field experiments indicated that under Oklahoma conditions ceresan dusting was less effective than delinting and gravity-grading of cotton seed [*R.A.M.*, xviii, p. 105] in increasing stand and yield. The improvement resulting from dusting, however, warrants a trial of this method when equipment is lacking for the acid treatment. In seven out of eight lots of cotton seed from Oklahoma and other States significant increases in stand of from 10 to 70 per cent. were given by ceresan dusting. There was no significant increase in yield, indicating that under the conditions prevailing locally in 1938 the chief advantage of the treatment was that it permitted a lower seeding rate than was possible with untreated seed. Laboratory tests confirmed the finding that cotton seed treated with ceresan regularly produces a higher percentage of healthy seedlings than untreated seed.

[Jensen (J. H.).] **Plant disease investigations.**—*Rep. P.R. agric. Exp. Sta., 1937*, pp. 82–92, 1938.

Bunchy top disease of papaw, hitherto thought to be due to a virus [*R.A.M.*, x, p. 398], is of some economic importance in Puerto Rico as it reduces yields and imparts an unpleasant taste to the fruits produced. Affected plants are severely stunted, produce dwarfed and shortened internodes, and show premature fall of the flowers. Apparently diseased plants sometimes recover, and are often cured by cutting away the diseased top. Attempts to transmit the disease by juice

inoculation (syringe and pin puncture), rubbing healthy leaves with juice from diseased ones, budding and grafting, all gave negative results; but plants from which insects were excluded remained unaffected, whereas unprotected plants from the same lots became diseased.

Sugar-cane leaves affected by chlorosis in Puerto Rico show yellowish-green, yellow, or yellowish-white interveinal areas lying between veinal areas of almost normal green. When the chlorosis is very severe the leaves turn nearly white, and the plants die. Affected leaves recovered their green colour when brushed or sprayed with a solution of ferrous sulphate.

Grapefruit trees moderately affected with mottle leaf [ibid., xviii, p. 308] completely recovered after one spray application of zinc sulphate (7 lb. per 100 gals. water).

**Department of Plant Pathology.**—*Rep. Del. agric. Exp. Sta., 1937–8* (*Bull.* 214), pp. 29–45, 3 figs., 1938.

The following items, apart from those already noticed from other sources, occur in this report. The data obtained (by T. F. Manns) from budding work with over 200 sources of wild plum from different parts of Delaware showed that only a few carried peach yellows or little peach [*R.A.M.*, xvii, pp. 223, 827]. The only vector of both viruses found was *Macropsis trimaculata*. When the vector was fed on peach trees affected with yellows or little peach and then transferred to healthy Elberta or natural peach seedlings, the amount of infection that developed seldom exceeded 12 per cent., whether 5, 25, or 100 insects were used on each plant. In a few instances infection reached 50 to 75 per cent. in the first season, while in a number of cases the insects failed to transmit little peach. Both wild and cultivated plums breed the vector in much larger numbers than do peaches, while well-cultivated, sprayed peach orchards hardly ever show the insect. A limited number of *M. trimaculata* were found in neglected peach orchards in upper Delaware, but seldom under similar conditions in the lower part of the State.

T. F. Manns selected 35 Marglobe, Rutgers, and Greater Baltimore tomato plants showing partial resistance to early blight (*Macrosporium* [*Alternaria*] *solani*) [ibid., xvii, p. 224] during a severe outbreak of the disease which destroyed 60 per cent. of the crop. Data were obtained indicating that the fungus is wind-borne. A number of plants apparently completely resistant to *A. solani* were found to be infected with mild mosaic.

T. F. Manns, J. W. Heuberger, and S. L. Hopperstead observed that during the severe outbreak of *Bacterium pruni* on peach in 1937 [ibid., xvii, p. 471], the buds on the young trees coming into bearing were so deeply infected that they showed the bacteria in a nutrient agar culture after a surface disinfection with alcoholic mercuric chloride (five parts mercuric chloride in 10,000 of 50 per cent. alcohol) when disinfected for 30 seconds. The percentage of bud infection appeared to fall markedly in winter, and in some instances only 1 to 5 per cent. of the buds were infected in January, February, and March. Dissemination of *Bact. pruni* was general from peach nurseries. Considerable evidence was obtained that the severity of infection is affected by the fertilizers applied. A ten-acre Elberta orchard given chicken manure (2 bush.

per tree) became completely defoliated, and the set of fruit, while abundant, was a complete failure in size and quality.

Итоги научно-исследовательских работ Всесоюзного Института Защиты Растений за **1936** г. Часть III. Вирусные и бактериальные заболевания растений, биометод, химизация и механизация защиты растений. [Summary of the scientific research work of the Institute of Plant Protection for the year 1936. Part III. Virus and bacterial diseases of plants, the biological, the chemical, and the mechanical methods of plant protection.]—111 pp., 2 figs., 5 diags., 3 graphs, Госуд. Издат. колх.-совх. Литер. „Сельхозгиз" [State Publ. Off. Lit. collect. co-op. Farming 'Selkhozgiz'], Leningrad, 1938.

This collection of papers by various authors [cf. *R.A.M.*, xvii, pp. 433, 438] on virus and bacterial diseases of various crops and on different methods of control contains the following items of interest.

S. M. Mashtakoff (pp. 3–5) reports that under field conditions in south-eastern U.S.S.R., shading potato plants by dusting with fine white clay either throughout the season or at certain intervals reduced the average number of plants showing symptoms of mosaic per plot from 8·4 in the control to 1·4, and spraying with a mixture of either clay or chalk (1 part to 7 of water) plus casein (0·3 per cent.) reduced the number from 12·6 and 10·2 to 2·1 and 5·8, respectively. A serological examination of the treated plants, however, revealed the presence of a masked X virus in most of them, indicating that the screening effect of the dusts and sprays merely weakens the pathogenicity of the virus. The yields of treated plants were from 0 to 56 per cent. higher than of the untreated. Covering the soil with chalk reduced virus infection by 50 per cent., but the yield was only equal to, or even slightly lower than, that of the control. Mulching with straw and simultaneous spraying with chalk or black aniline dye reduced the number of virus-diseased potato plants by 30 and 15 per cent., respectively, and increased the yield by 18 and 64 per cent., respectively.

M. S. Dounin and Mme E. V. Shatova (pp. 6–7) state that in the Moscow district in 1936 from 4·4 to 45 per cent. of black currant plants were found to be affected by reversion [ibid., xvi, p. 822], the nursery which had supplied the seedlings for some of the chief plantations of the district being almost completely infected. The yields of severely reverted plants is reduced to 3·5 per cent. of the normal. Raspberry plantations were found to be severely affected by yellows, mosaic [ibid., xviii, p. 190], streak, leaf roll, leaf curl, and dwarf, the two chief commercial varieties, Usanka and Marlborough, showing from 75 to 100 per cent. and from 20 to 35 per cent. of virus infection, respectively. Reports on the wide distribution of these virus diseases of raspberries have also been received from several other districts of the Soviet Union.

Mme N. N. Popova (pp. 10–12) describes the preliminary results of experiments in which potato leaves infected with rugose mosaic were dried at 25° C., stored for various periods at 20° to 25°, later soaked in distilled or boiled water for two to three hours, and the expressed fluid then tested for the presence of the precipitinogen of the X virus. It appeared from the results obtained that the precipitinogen was

preserved in dried leaves for over three months, and it is concluded, therefore, that dried leaves can be safely used for serological tests by the drop method [ibid., xvii, p. 762].

Mme E. V. Shatova (pp. 12–14) states that X virus sap isolated from rugose mosaic potatoes and purified by means of aluminium hydroxide gel had a higher infectivity at a dilution of 1:10,000, produced symptoms in *Nicotiana glutinosa* earlier, and contained less dry residue than when purified by means of silica gel, kaolin, or specific serum.

The same author in another paper (pp. 14–16) relates that the X and Y viruses received from K. M. Smith from England were found to be more pathogenic and to differ in some respects from the X and Y viruses isolated from potato varieties Lorch and Deodara in U.S.S.R. It was found experimentally that the Russian strain of virus X has the same inactivation point (66° C.) as that recorded by Henderson Smith, but a lower one than that found by Koch and Böhme [cf. ibid., xii, p. 588], while the Russian strain of virus Y has a somewhat higher inactivation point (58°) than that found by Henderson Smith (52°), and seems to resemble the strain studied by Koch, differing from the latter, however, in not inducing veinbanding.

Mme N. N. Popova (pp. 17–20) investigated the conditions under which the anti-virus serum X can be stored without losing its activity. The liquid sera, diluted with physiological solution plus 0·5 per cent. phenol and stored at 25° to 33° C., were still good after one month. The titre of such sera stored at 5° for 5½ months was considerably higher than that of those stored at 25°. Sera dried in drops on glass slides or films of acetyl cellulose lost their activity more quickly than liquid sera, so that they are not recommended for use later than ten days after drying.

D. E. Belenky (pp. 20–22) was able to identify the X-bodies in the sap of *Nicotiana glutinosa* leaves infected with potato virus X by using the Fontana-Tribandeau method of staining. The dried films of the clarified virus-infected sap were fixed with an acetic acid-formalin mixture treated with a hot aqueous solution of phenol and tannin and stained with a freshly prepared solution of ammonia and silver nitrate. The X-bodies had the appearance of very small, round, dark brown grains, more or less visible against the yellow tobacco background.

N. D. Khrobrykh (pp. 27–30) discusses the results of experiments with various forms of *Spongospora subterranea* from different varieties of potatoes of different geographical origin and arrives at the conclusion that these forms are not biotypes or geographical races, but 'ecotypes', dependent on the host variety, the height and to some extent the size of their pustules varying with the humidity and aeration of the soil.

B. P. Matzulevitch (pp. 31–32) applied the biological and serological methods of diagnosing rugose and streak mosaic diseases of potato to corresponding halves of healthy and diseased tubers of 11 different varieties. The results showed that rugose mosaic was correctly diagnosed by the serological method in 9 out of 11 tubers tested, and streak mosaic in 25 out of 28 [cf. ibid., xviii, p. 127].

V. I. Vzoroff (pp. 40–45) gives a list of 60 bacteria distributed throughout U.S.S.R. with their respective hosts, including the following species recorded for the first time in Europe: *Bacterium aleuritidis* on tung, *Bact. atrofaciens* on tomato and potato, *Bact. cerasi* on fruit trees, *Bact.*

*croci* on onion, *Bact. hibisci* on *Hibiscus*, *Bact.* [*Aplanobacter*] *insidiosum* on lucerne, *Bact. jaggeri* [ibid., xvii, p. 660] on celery, *Bact. oryzae* n.sp. [without a diagnosis] on rice, *Bact. phaseoli* var. *sojense* on soy-bean [ibid., xviii, p. 368], *Bact. ricinicola* n.sp. [without a diagnosis] on the castor plant [*Ricinus communis*], *Bact. striaefaciens* on oats and barley, *Bact. vesicatorium* on tomato, *Bact. vignae* and its var. *leguminophilum* on cowpea [ibid., xvi, p. 85], *Bact. vitians* on lettuce [ibid., xvi, p. 302], and *Bact. cerealium* on barley. The material for this study, consisting of over 900 samples of 98 plants received from 82 different parts of the Soviet Union, was examined in pure culture and identified by the standard technique of the biological department of the Rostoff Experiment Station for Plant Protection.

N. P. Markevitch (pp. 45–50) found that when potato tubers infected with *S. subterranea* were grown in pots in either artificially infected or clean soil with a moisture content of 90 to 100 per cent. and a hydrogen-ion concentration of $P_H$ 6·3 to 6·7, the percentage of infection was dependent upon the temperature, being 70 and 63·7 at mean daily temperatures of between 15·5° and 19·5° C., respectively, and only 4 and 2·9 at between 18·7° and 24·2°, respectively, while the hydrogen-ion concentration of the soil exerted no influence. Infection originated mainly through infested soil, but partly through infected seed material and utensils, and was actively spread by earthworms. The incubation period in artificially infected plants lasted from 19 to 25 days. In a comparative study of eight samples of infected material from five different districts, four distinct forms of the fungus were isolated, which varied in the size and height of the pustules and some other basic characters. These forms are regarded as ecological forms mainly dependent on the variety of potato.

V. F. Volkoff (pp. 67–69) conducted experiments for the control of *Loxostege sticticalis* with strains 1 to 5 of *Beauveria bassiana* [cf. ibid., xvii, p. 744] isolated from larvae of *L. sticticalis*, and strains 6 and 7 of the same fungus isolated from *Agrotis* [*Euxoa*] *segetum*. Artificial infection experiments by dusting or spraying with spores under laboratory conditions gave the following results: at a temperature of 20° to 23·6° C. and relative air humidity of 54 to 82 per cent. strains 1 to 7 killed 5, 6, 6, 8, 5, 3, and 2 larvae out of 10, respectively; under conditions closely approximating to those in nature strains 1 to 5 all gave good results, particularly strain 4, which killed all the larvae. Mortality among butterflies of *L. sticticalis* put into glasses contaminated with pure cultures of *B. bassiana* was 90 per cent. of the females and 60 per cent. of the males after 4 to 7 days, as compared with 20 and 50 per cent., respectively, in the control, and no eggs were laid. Dusting was generally observed to give better results than spraying. Field experiments with strains 6 and 7 were unsuccessful, but better results may be expected with strain 4.

Mme A. Y. Zaitseva (pp. 69–73) used spores of three strains of Métalnikov's bacilli [ibid., xvii, p. 232] in experiments on the control of larvae of various noxious insects. In the laboratory, applications of the bacillus in the form of dusts killed 40 per cent. of the larvae of *Loxostege sticticalis* and all those of *Pyrausta nubilalis*, *Pieris brassicae*, and *P. rapae*, and applications by sprinkling killed up to 88, 95, 100, and

100 per cent. of the larvae of *L. sticticalis*, *P. brassicae*, *P. rapae*, and *Plutella maculipennis*, respectively. In the field up to 92, 77, 45, and 88 per cent. of the larvae of *P. maculipennis*, *Pieris rapae*, *Barathra brassicae*, and *P. brassicae*, respectively, were killed by dusting, and up to 100 and 73 per cent. of the larvae of *P. brassicae* and *P. rapae*, respectively, by sprinkling. The mortality of the larvae was more than three times as high at a temperature of 24° C. than at 14°. The bacilli were also found to exercise an antagonistic effect on *Ustilago zeae* on maize under field conditions, though the results were less marked than those obtained in 1934 by V. P. Pospeloff [ibid., xvi, p. 36], owing to the high temperatures and low humidity predominant in 1936.

M. V. Pilat (pp. 73–75) describes histological studies on the penetration of the chitin of *L. sticticalis* larvae by *B. bassiana*. The hyphae of the fungus were observed to enter the body of the larva either from the outside, penetrating the chitin and branching downwards till they reach and destroy the hypoderm, or through the intestinal tract, in which case the hyphae are thicker, branch more frequently, and often change their direction, but ultimately reach the chitin, form spherical swellings just beneath it, penetrate it, and then sporulate on the outside. Analogous observations were made on *P. brassicae*, *A.* [*E.*] *segetum*, and *Melolontha hippocastani*. *Spicaria fumosa-rosea* [ibid., xvi, p. 532] and *Metarrhizium anisopliae* [ibid., xvii, p. 456] gave similar results. The author is inclined to ascribe the method of penetration of the chitin by the hyphae to the solvent action of the fungus, as lighter patches have often been observed to form round the growing hyphae.

Mme A. A. Evlakhova (pp. 75–77) in inoculation experiments with spore suspensions of *Cephalosporium lecanii* [cf. ibid., xvii, p. 526] found that strain No. 14 of the fungus isolated from *Coccus hesperidum* caused 100 per cent. mortality of *Ceroplastes sinensis* on tangerine trees in the field (or 46 to 69 per cent. when rain set in two or three days after sprinkling), and strain No. 6, isolated from *Saissetia oleae*, caused up to 32·5 per cent. mortality, while the insects on the unsprinkled branches of the trees remained unaffected. The fungus was observed to penetrate the thick chitin and wax layer of the insects from within.

I. P. Yatzenko and B. F. Snigur (pp. 96–99) give some details on the improved construction of a mobile power sprayer S-2, designed for use in beet plantations.

N. K. Tarnovitch (pp. 99–104) describes and gives diagrams of a new sprayer for work on cotton, lucerne, or garden crops, which is mounted on a tractor and can be served by the tractor-driver without additional workers. The spraying hose being fixed in front of the tractor the driver is able to watch and direct it. The machine is calculated to spray 22 hect. in a 10-hour working day.

Gosset (A.), Tchakirian (A.), & Magrou (J.). **Sur la composition chimique des tumeurs bactériennes de Pelargonium zonale et des tissus aux dépens desquels elles se développent.** [On the chemical composition of the bacterial tumours of *Pelargonium zonale* and of the tissues at the expense of which they develop.]—*C. R. Acad. Sci., Paris*, ccviii, 7, pp. 474–477, 1939.

Details are given of the technique and results of chemical analyses

of crown gall (*Bacterium tumefaciens*) tumours on *Pelargonium zonale* [*R.A.M.*, xviii, p. 296] and of the host tissues involved in their development. The inoculations were carried out with the hop strain of the bacterium on 28th February, 1935, and three collections of test material made on the following 23rd May, 3rd July, and 15th August.

There was found to be very little difference in the ash and water contents of the tumours, stems, and leaves. The tumours contained considerably more potash and phosphorus than the plant organs, the figures for these two elements being as follows: (1) potash (May), tumours, stems, and leaves, 35·1, 22, and 23·3 per cent., respectively, of fresh substance, the corresponding amounts for July and August being 37·7, 17·7, and 26·2 and 36·6, 19·7, and 16·9, respectively; (2) phosphorus (May), tumours, stems, and leaves, 2·9, 1·4, and 2·5; July, 2·6, 0·6, and 1·2; and August, 3·6, 1·4, and 1·8 per cent., respectively. On the other hand, the silicon, calcium, and magnesium contents of the tumours were lower than those of the host stems and leaves. Thus, the silicon contents of the tumours in May, July, and August were 0·94, 0·91, 0·89 per cent., respectively, the corresponding figures for the stems and foliage being 2·87, 1·66, and 1·25, and 14·12, 12·8, and 9·38, respectively. For magnesium the following values were obtained in the three analyses: tumours, 1·9, 1·8, and 1·8, stems, 2·4, 2·2, and 2·1, and leaves, 3·5, 2·5, and 2·6, the corresponding figures for calcium being 10·2, 10·4, and 11, 23·3, 25·9, and 22, and 16·3, 18·6, and 23. The iron, aluminium, and sodium data were too variable to admit of any definite conclusion as to their bearing on the matter under investigation.

Hornbostel (W.). **Versuche über Wurzelkropfbekämpfung.** [Experiments on the control of crown gall.]—*Z. PflKrankh.*, xlix, 1, pp. 1–11, 5 figs., 1938.

In pot experiments with one-year-old apple and pear stocks, in which the trees were wounded at the root collar and the wounds smeared prior to planting with a pure culture of *Pseudomonas* [*Bacterium*] *tumefaciens* [see preceding abstract] either immediately or some time later, tumour development occurred only in stocks inoculated immediately after injury. In a second similar experiment inspection at the end of the vegetation period of 45 apple and 40 pear stocks showed 63, 12, 0, 0, and 0 per cent. infection in apple stocks inoculated and planted immediately, 2, 7, 10, and 20 days after wounding, respectively, and 83, 60, 38, 8, and 0 per cent. in pear stocks similarly treated, respectively.

In field experiments the roots of one-year-old apple stocks were pruned after dipping for ten minutes in a 0·5 per cent. uspulun solution in order to avoid accidental infection, stored for different periods in the field or cool store, and then inoculated either with pure cultures of the parasite or with tumour material, and planted. The results showed that the introduction of an interval between root pruning and planting reduces the amount of infection. In the series inoculated with tumour material, the controls inoculated and planted immediately after pruning showed 11·7 per cent. healthy and 77·8 per cent. diseased trees (the rest being doubtful), while stocks inoculated and planted from 2 to 19 days after pruning yielded an average of 68·4 per cent. healthy and

25·1 per cent. diseased trees; the average number of tumours per tree in the latter stocks was 0·52 as compared with 3·8 in the controls. In the series inoculated with pure cultures the controls showed 50·5 per cent. healthy and 41·9 per cent. diseased trees, with an average of 0·67 tumours per tree, while stocks inoculated and planted from 4 to 19 days after pruning showed 91 per cent. healthy and 6·2 per cent. diseased trees, with an average of 0·12 tumours per tree. The temperature during storage did not seem to have a significant influence on infection.

It is concluded that the formation of callus growth over the wounds inflicted in pruning occurs within a few days after pruning, and that delaying planting for this period will reduce the infection to an appreciable degree. It is also recommended that the soil at planting be disinfected with 1 per cent. uspulun or ceresan or 0·5 per cent. abavit and the pruned stocks dipped in 1 per cent. uspulun or ceresan loam emulsion prior to planting.

Hornbostel (W.). **Die Beziehungen zwischen Bodenreaktion und Wirkung quecksilberhaltiger Bodenentseuchungsmittel auf den Wurzelkropferreger Pseudomonas tumefaciens Smith et Townsend.** [The relations between soil reaction and the effect of mercury-containing soil disinfectants on the agent of crown gall, *Pseudomonas tumefaciens* Smith & Townsend.]—*Z. PflKrankh.*, xlix, 2, pp. 77–93, 1939.

The *doses curativae* of two standard soil disinfectants for the control of crown gall (*Pseudomonas* [*Bacterium*] *tumefaciens*) viz., uspulun for soil disinfection and ceresan liquid (U. 564) [see preceding abstracts], were determined in laboratory experiments and found to depend on the hydrogen-ion concentration of the soil (sandy loess). The efficiency of the two preparations was materially increased in acid soil ($P_H$ 6·1), twentyfold in the case of uspulun, and fivefold in that of ceresan. Thus, in alkaline soil ($P_H$ 7·6) a 0·01 per cent. solution of uspulun is required to destroy the bacteria in 24 hours, whereas comparable effects are achieved in the same period at $P_H$ 6·1 by a 0·0005 per cent. concentration. In the acid soil ceresan exerted a bactericidal influence at 0·01 per cent., whereas in the alkaline a 0·05 per cent. solution was necessary to produce the same results. These data were confirmed by tests of the pathogenicity of the two preparations to *Bact. tumefaciens* on a liquid bouillon medium, which increased parallel with a fall in the hydrogen-ion concentration. Phenol and quinosol [ibid., xv, pp. 61, 420] proved to be inferior to uspulun and ceresan for the purpose of these experiments.

Blattný (C.), Duchoň (F.), & Straňák (J.). **Přispěvek k seznání vztahu mezi obsahem hlavních rostlinných živin ve slámě Pšenic a jejich napadením rzi travní Pšeničnou (Puccinia graminis Pers. f. tritici Er.).** [Contribution to the study of the relationship of the content of the chief plant nutrients in Wheat straw to susceptibility to black rust (*Puccinia graminis* Pers. f. *tritici* Erikss.).]—*Ann. Acad. tchécosl. Agric.*, xiii, 4, pp. 529–534, 1938. [German summary.]

The authors state that the results of the chemical analysis of the

straw of wheat varieties exhibiting different degrees of susceptibility or resistance to black rust (*Puccinia graminis tritici*) did not indicate any direct relationship between susceptibility or resistance and the content of any individual essential element. There was evidence, however, that any upsetting of the balance in the wheat plant between the groups of protein- (nitrogen and phosphorus) and skeleton-building elements (potassium, calcium, and manganese) increased susceptibility to rust or, more generally, reduced the grain yield of the plant. From a purely practical standpoint, these results are considered to indicate the inadvisability of applying mineral fertilizers to wheat fields without preliminary analysis of the soil.

KUMMER (H.). **Untersuchungen über die biologische Spezialisierung des Schwarzrostes in Württemberg.** [Studies on the biologic specialization of black rust in Württemberg.]—*Z. PflKrankh.*, xlix, 2, pp. 65–76, 1939.

Ten collections of black rust (*Puccinia graminis*) from various parts of Württemberg [*R.A.M.*, xvii, p. 21] in 1937 yielded five biotypes of the fungus, of which race 14 [ibid., xvii, p. 225] predominated, occurring in six samples, mostly on emmer, which also contracted severe infection in inoculation experiments. Race 40 [loc. cit.] was detected twice on wheat, and 143, originally reported by Dodoff from Bulgaria [as 129: ibid., xiii, p. 500], once on barley. Race 56 was isolated from a collection of the rust on wheat referred to E. C. Stakman for determination, this being the first record of its occurrence in Europe. A new race (not yet numbered) from emmer was tested by Stakman and found to be severely pathogenic to the Hope variety but only slightly so to Thatcher; in the writer's experiments it produced heavy infection on emmer.

The only sample of oats among the collections yielded race 6 of *P. g. avenae* [ibid., xvii, p. 225], which caused severe damage to the Hohenheim No. 5 and Jäger's Alb in inoculation trials and is probably responsible for the not infrequent local epidemics of black rust on this host.

The two races of *P. g. secalis* isolated from *Agropyron repens* were actively pathogenic to cultivated rye, emphasizing the importance of wild grasses in the spread of the rust.

ASUYAMA (H.). **On the period of infection of Wheat seedlings by leaf rust, Puccinia rubigo-vera tritici.**—*Ann. phytopath. Soc. Japan*, viii, 4, pp. 298–308, 1939. [Japanese, with English summary.]

Observations on wheat seedlings inoculated with the uredospores of *Puccinia rubigo-vera tritici* (*P. triticina*) [*R.A.M.*, xii, p. 499] and kept in a moist chamber at various constant temperatures showed that infection occurred with the formation of a penetration tube from the appressorium, and inoculated seedlings require to be maintained in favourable conditions until this stage is attained in order to obtain infection. At about 23° C. the uredospores germinated within one hour, and appressoria were found three hours after inoculation. Approximately one-third to one-half of the germinated spores produced appressoria after seven to nine hours. Penetration tubes were noted four hours,

and most frequently nine hours, after inoculation; at 24 hours from inoculation, 93·1 per cent. of the appressoria showed substomatal vesicles and 77·6 per cent. had developed infection hyphae.

Spore germination was inhibited at 28°; at 15° to 25° appressoria formed three or more hours after inoculation, and at 8° to 13° they formed six or more hours after inoculation. At temperatures over 15° stomatal entry occurred three to six hours after inoculation, while at those below 13° it took place nine hours after inoculation. At temperatures over 18° haustoria formed 14 to 24 hours after inoculation, while at 8° infecting hyphae were still developing 24 hours after inoculation.

The germination and subsequent development of uredospores kept in a refrigerator for 158 days were markedly retarded in comparison with fresh spores.

The shortest periods for infection at 8° to 13°, 15° to 20°, and 23° were, respectively, 9, 6, and 3 hours. Abundant infection resulted when the inoculated surface was kept moist for 14 hours at 8° to 13° and for six hours at temperatures over 15°. In general, the optimum temperature for the infection of wheat by *P. triticina* would appear to be from 18° to 25°.

Adams (W. E.). **Inheritance of resistance to leaf rust in common Wheat.**—*J. Amer. Soc. Agron.*, xxxi, 1, pp. 35–40, 4 graphs, 1939.

A tabulated account is given of the writer's investigations in North Carolina in 1934–5 on the inheritance of resistance to leaf rust (*Puccinia triticina*) [*R.A.M.*, xiii, p. 428; xiv, p. 497; xvi, p. 90, et passim] in crosses between the resistant, hard red spring wheat Hope and three leading susceptible, soft red, winter varieties, Leap's Prolific, Fulcaster, and Purplestraw.

The $F_1$ generation developed very little infection, due either to paucity of inoculum, unfavourable weather conditions for spore production, or both. In the $F_2$ the Hope×Leap's Prolific cross segregated into immune, intermediate, and susceptible plants, of which 81 per cent. showed below 25 per cent. infection and nine individuals less than 1 per cent. The reciprocal cross yielded slightly less resistant progeny, with 63 per cent. showing below 50 per cent. infection, 31 per cent. in the 25 to 50 per cent. class, and two plants 1 to 4 per cent. None of the Purplestraw×Hope plants showed over 50 per cent. infection, 91 per cent. showed less than 25 per cent., and 27 per cent. under 5 per cent. The highest degree of resistance was displayed by the Hope×Fulcaster cross, with 70 per cent. below 4 per cent. and all less than 50 per cent. rusted. In the $F_3$ Purplestraw×Hope showed four rows under 1 per cent., six intermediate, and three fairly heavily infected. Three rows of Hope×Fulcaster showed less than 1 per cent. infection, five were intermediate, and three were severely attacked. The offspring of Hope×Leap's Prolific produced six resistant rows (most of the plants healthy), five intermediate, and six with over 50 per cent. infection, while in the reciprocal cross there were five rows showing under 1 per cent. infection, five intermediate, and three in which all the plants were over 50 per cent. rusted.

An evaluation of these data is complicated by the variable soil and climatic conditions under which the tests were conducted in two

localities, the differing times of maturity of the wheats, and the impossibility of avoiding a mixture of physiologic races of the rust. It would nevertheless appear from the segregation of the hybrid descendants into well-marked infection categories that resistance to *P. triticina* is a heritable character.

ROSENSTIEL (K. v.). **Untersuchungen über den Weizenmeltau Erysiphe graminis tritici (D.C.), seine physiologische Spezialisierung sowie die züchterischen Möglichkeiten seiner Bekämpfung (vorläufige Mitteilung).** [Investigations on the Wheat mildew *Erysiphe graminis tritici* (DC.), its physiological specialization, and the possibilities of controlling it by breeding (preliminary report).—*Züchter*, x, 9–11, pp. 247–255, 4 figs., 1938.

The author tested the wheat material collected by the German Hindu Kush expedition of 1935 and the wheat assortment from Müncheberg, Mark Brandenburg, for resistance to *Erysiphe graminis* [*R.A.M.*, xiii, p. 431], and having thus established a number of resistant varieties studied the physiological specialization of the fungus. Isolations of single spore lines were not made and a test assortment of differential varieties has not yet been decided upon owing to the great number of new races continually being discovered during the study. Six populations of the fungus, however, namely, one from Müncheberg, two from Alt-Reichenau, Silesia, three isolated from population 1 on T 2948 Normandie, four found on T 3397 Christiansen 16 (*Triticum durum*), five from Huckelheim (near Frankfurt-am-Main), and six isolated from population 5 on T 1643, T 2922, T 3276, and T 4199, were differentiated and are considered probably to be distinct physiological races, though as single spore lines have not been studied the author prefers to term them populations. Wheat varieties Red summer spelt, Christiansen 118, Persian heavy summer wheat, 13392, and Christiansen 919 were found to be resistant to all six populations. The other 72 strains tested are classified in five groups according to their capacity to resist 5, 4, 3, 2, or 1 populations.

GRAM (E.). **Forsøg med Korndyrkning og Fodsyge.** [Experiments with cereal cultivation and foot rot.]—*Tidsskr. Planteavl*, xliii, 4, pp. 561–605, 8 graphs, 1938. [English summary.]

A detailed, tabulated account is given of a series of experiments, mostly planned by C. A. Jørgensen and carried out from 1923 to 1937 in Denmark, to determine the effect of summer crops of oats and barley on the development of foot rot (*Ophiobolus graminis*) [*R.A.M.*, ix, p. 741] and *Cercosporella herpotrichoides* [ibid., xiii, p. 623] on winter rye and wheat.

Seed-grain disinfection failed to produce any significant cumulative reduction in the incidence of infection in four years' consecutive trials. The observations made by Kølpin Ravn and Rostrup in the eighteen-nineties regarding the stronger predisposition to foot rot of wheat following barley than in the same crop succeeding oats were largely confirmed in these experiments. Foot rot is prevalent in barley but the actual damage from this cause is generally unimportant, its influence being more of an indirect character, severe attacks on oats are

rare. In plots well supplied with nitrogen [cf. ibid., xviii, p. 241] the average grain yield of rye was 25 per cent. less following two years of cereals than after three to five of root crops; there was a similar reduction in wheat succeeding three to four years of cereals, five or six of which caused a 50 per cent. loss in the wheat crop. Potatoes and beets were found to be the best crops to precede rye, oats and barley, particularly the latter, being unfavourable; the yield following barley was 12 to 20 per cent. lower than that from stands succeeding oats. No appreciable difference in the condition of the wheat crop was observed following one barley or oats crop, but the cumulative influence of the former was definitely adverse.

In a test on very fertile soil at Lyngby wheat was grown in two rotations, viz., A, consisting of wheat-barley-wheat-barley-wheat, and B, hay-oats-potatoes-peas and mustard-wheat, the incidence of foot rot was as follows: A with and without 300 kg. nitrate per hect., 52 and 78 per cent., respectively; B with and without nitrate, 6 and 10 per cent., respectively, the corresponding grain yields in the four plots being 1,320, 610, 3,090, and 2,090 kg. per hect., respectively. Nitrate is ineffectual against heavy foot rot infection, but may serve to reduce the losses caused by the disease as long as super-luxuriant growth and lodging are not induced.

It is concluded from these observations that the crop most liable to predispose wheat and rye to foot rot is barley, followed in descending order of injuriousness by oats, red clover [*Trifolium pratense*] grass-mixture, fodder beets, lucerne-grass mixture, and fallow.

Hansen (H. R.). **Om Fodsyge hos Korn paa Grundlag af udenlandske Undersøgelser.** [On foot rot of cereals on the basis of foreign investigations.]—*Tidsskr. Planteavl*, xliii, 4, pp. 630–645, 4 pl., 1938.

This is a summary of recent outstanding developments in research on cereal foot rots (chiefly *Ophiobolus graminis* and *Cercosporella herpotrichoides*) [see preceding abstract] in various countries. Attention is drawn to the restricted distribution of *C. herpotrichoides* in comparison with the very widespread *O. graminis*.

Garrett (S. D.). **Soil conditions and the take-all disease of Wheat. IV. Factors limiting infection by ascospores of Ophiobolus graminis.** —*Ann. appl. Biol.*, xxvi, 1, pp. 47–55, 1 pl., 1939.

In further experiments on the take-all disease of wheat (*Ophiobolus graminis*) [*R.A.M.*, xviii, p. 171], the author failed to produce infection of seedlings by the ascospores in a variety of natural soils and in sand, although the ascospores usually showed a germination of over 90 per cent. on 0·5 per cent. dextrose agar, and the resulting cultures produced infection as easily as those from the mycelium. On sterilized soil in tubes, on the other hand, infection with ascospores was successful in 17 out of 20 seedlings and in all seedlings on sterile sand with or without the addition of 1 per cent. glucose solution. The ascospore infection is, therefore, considered to be inhibited in unsterilized soils and sand by the antagonism or more probably the competition of other soil micro-organisms, which assimilate the nutritive substances excreted from the

growing and developing roots. Only under sterile conditions is this organic detritus available to the ascospores. These experimental results render it unlikely that the ascospores can play any part in the propagation and dispersal of the disease in the field.

Nisikado (Y.) & Higuti (T.). **Comparative studies on Cephalosporium gramineum Nisikado et Ikata, which causes the stripe disease of Wheat, and C. acremonium Corda.**—*Ber. Ōhara Inst.*, viii, 3, pp. 283–304, 5 pls., 4 graphs, 1938.

The results of comparative studies on *Cephalosporium gramineum*, the agent of stripe disease of wheat in Japan [*R.A.M.*, xvii, p. 593], isolated from blackened culms of the Tinko-Komugi variety and *Alopecurus agrestis*, and three strains of *C. acremonium*, associated with black bundle of maize [ibid., xvi, p. 168], from Holland, Germany, and Italy, revealed the following important differences. The conidia of *C. gramineum* on potato dextrose agar at 20° C. measured 4 to 12 by 1 to 3·3 (average 7·22 by 2·09) $\mu$. The orange-yellow colour of the colonies of *C. acremonium* in diffused daylight was absent from those of *C. gramineum*. The minimum, optimum, and maximum temperatures for the growth of *C. gramineum* were 5°, 20°, and 30°, respectively, compared with 10°, 30°, and 38° for *C. acremonium*. In inoculation experiments *C. acremonium* proved to be unable to attack wheat plants and cause the typical systemic symptoms of stripe disease. The two species are, therefore, quite distinct.

D'Oliveira (B.). **Studies on Puccinia anomala Rost. I. Physiologic races on cultivated Barleys.**—*Ann. appl. Biol.*, xxvi, 1, pp. 56–82, 1939.

In a study based on 77 collections of *Puccinia anomala* from cultivated barleys obtained from England, Portugal [*R.A.M.*, xvii, p. 593], and Spain, carried out from 1933 to 1936 partly at Cambridge and partly at Lisbon, 11 new physiologic races of *P. anomala* were isolated from 82 cultures of the fungus and were numbered 12 to 22. The differentiation of physiologic races was made chiefly on Hey's selection of differential barleys, in addition to which seven of Mains's differential varieties and the Egyptian 4-rowed summer barley, selected by Gassner and Straib, were used. Monospore cultures of *P. anomala* were obtained by three methods, among them a new one, consisting in the transfer of individual spores from a dry glass slide with a wet glass capillary needle to the leaf of a seedling. All stock cultures were maintained on seedlings of Spratt Archer barley kept under spore-proof cellophane cylinders or in a rust-free room of the greenhouse.

Of the new races, 12 was found to be widely distributed in Great Britain, Portugal, and Spain, the other ten were localized; races 13, 14, 15, and probably 18 were found in Britain; races 18, 19, 20, and 21 in Portugal; and races 16, 17, 21, and 22 in Spain. A mutant of *P. anomala*, differing in colour (orange and yellow pustules instead of the normal brown ones) and pathogenicity, arose from an unstable culture of race 14 cultivated on *Hordeum vulgare pallidum* (Sudan), and was numbered race 23.

New physiologic races were obtained from aecidia produced on *Ornithogalum umbellatum* by hybridization. The races 12, 13, and 23

proved to be heterozygous. From self-fertilized material of race 12, the new races 24, 25, 26, and 27 were isolated in addition to races 12, 16 (?), and 19; by selfing race 13, races 12 (?), 13, 22, 24, and the new races 28 and 29 were obtained; and the selfing of race 23 yielded races 12, 19, 20, and 22. The progenies of a reciprocal cross between races 13 and 23 gave rise to one new race, 30, in one direction, and to the same race and 18, in the other. This result is explained on the basis of cytoplasmic inheritance. Several biotypes of races 12 and 13 were found, which seem to link up the two races.

The author suggests the following set of varieties for the purpose of more efficient differentiation: Breustedt's Schladen, *H. v. speciale*, Friedrichswerth Berg winter barley, Australian Recka, Lichtis Lechtaler, Samaria 4-rowed, *H. v. pallidum* (Sudan), Egyptian 4-rowed summer, Quinn C.I. 1024, and Bolivia C.I. 1257, to which Oderbruck C.I. 940 may be added as a subsidiary variety. A table of the reaction types of the thirty physiologic races now known of *P. anomala* on this proposed set of barleys is given and an analytical key for their determination provided. It is concluded from field observations that *P. anomala* may overwinter at Cambridge either in its uredospore stage or as dormant mycelium, and that in Portugal the uredospores survive the summer in the mountains.

Shands (R. G.). **Chevron, a Barley variety resistant to stem rust and other diseases.**—*Phytopathology*, xxix, 2, pp. 209–211, 1939.

Five years' observations at Madison, Wisconsin, on Chevron C.I. 1111, a four-rowed spring barley (*Hordeum vulgare pallidum*) of Swiss origin, have shown it to possess a degree of resistance to stem rust (*Puccinia graminis*) comparable to that of Peatland [*R.A.M.*, xii, p. 753]. In 1935 susceptible varieties contracted 20 to 25 per cent. infection, whereas the two resistant ones remained rust-free, and in 1937, when a severe natural outbreak of *P. graminis* developed in the barley nursery, Chevron showed an average of only 1 per cent. compared with 74·8 for 75 other varieties. Similar results were obtained in Iowa and Minnesota. All the 25 progenies of Chevron, selected at random, were likewise uniformly resistant to stem rust, the character being apparently inherited as a single dominant factor, judging by the segregation data of back-crosses with Wisconsin Pedigree 38, Velvet, X 152, and X 169. Chevron has further given proof of high resistance to scab (*Gibberella saubinetii*) and mildew (*Erysiphe graminis hordei*) [ibid., xvi, p. 376], and moderate resistance to stripe (*Helminthosporium gramineum*), but it is susceptible to leaf rust (*P. anomala*) [see preceding abstract], and apparently also to the sporidium-forming smuts [*Ustilago hordei* and *U. medians*: ibid., xvi, p. 737].

Kutzevol (E. A.). К вопросу об искусственном заражении Ячменя каменной головней **(Ustilago hordei Kellerm. et Sw.)** для целей селекции. [Artificial infection of Barley with covered smut (*Ustilago hordei* Kellerm. & Sw.) for Barley-breeding purposes.]—*Pl. Prot., Leningr., 1938*, 17, pp. 86–88, 1938. [English summary.]

Experiments in 1936 at the Donetz Experimental Station showed that dusting barley seeds, the seed coats of which had been slightly

lifted over the embryo, with covered smut (*Ustilago hordei*) spores resulted in 32·98 to 45·57 (average 39·5) per cent. infection in the ensuing crops, as compared with an average of 2·85 per cent. in the controls with untouched seed coats. Sprinkling the incised seeds with a river water suspension, in which the spores had been allowed to germinate for 24 hours at 20° C., raised the percentage infection to between 47·11 and 58·08 (average 52·48), but infection rapidly fell off when the spores were left to germinate for longer periods (48 or 72 hours) in the suspension. It is considered that mechanical injury sustained by barley seeds during threshing undoubtedly increases its susceptibility to infection with covered smut.

Marland (A. T.). Скорость инфекции Овса уредоспорами **(Puccinia coronifera Kleb.).** [Time required for infection of Oat plants by uredospores (*Puccinia coronifera* Kleb.).]—*Pl. Prot., Leningr., 1938*, 17, pp. 134–137, 1938.

Brief details are given of experiments the results of which showed that on the Golden Rain oat variety the germ-tubes of uredospores of *Puccinia coronifera* [*P. lolii*] had penetrated the surface of the leaves after three hours' incubation at the optimum temperature (20° to 22·8° C.) for the germination of the spores; the shortest time for the appearance of the rust pustules was five hours at temperatures ranging from 17° to 27°. No infection was observed below 4° or above 31·4°, and the first pustules appeared after 24 hours at 4·5° to 5·5°, and after 12 at 30° to 31·4°.

Reid (W. D.). **Halo-blight of Oats.**—*N.Z. J. Sci. Tech.*, A, xx, 4, pp. 266–268, 2 figs., 1938.

Attention is drawn to the detection, in December, 1937, of halo blight of oats (*Bacterium coronafaciens*) [*R.A.M.*, xviii, p. 235] in the Lincoln and Wanganui districts of New Zealand, this being the first record of the disease for the country.

Dunlap (A. A.). **Lodging of Sorghum in Texas.**—*Plant Dis. Reptr*, xxii, 20, pp. 402–403, 1938. [Mimeographed.]

Severe lodging of sorghum, especially the pithy-stemmed varieties, such as Milo and Feterita, in north-western Texas in the late summer and early autumn of 1938 was found to be associated with high percentages of infection by *Sclerotium bataticola* [*Macrophomina phaseoli*: cf. *R.A.M.*, xi, p. 711; xvi, p. 310]. Affected spots in the field are circular, with nearly all the stalks broken a few inches above soil-level. Other symptoms include drying out of the entire plant, premature ripening, under-developed kernels, and disintegration of the pith in the lower stalk, leading to collapse of the stem. The disease may have been favoured by the unusual weather conditions of the year, the abundant rainfall during the early part of the growing season being followed by a dry spell from mid-July to early October. In a few cases the sclerotia of the fungus were detected in the short stubs of decayed roots of standing plants near the edge of a lodged area. *M. phaseoli*, sometimes accompanied by an unidentified fungus, was consistently isolated from the diseased tissues.

Gemmell (A. R.). **Synergism in fruit-rotting fungi.**—*Chron. bot.*, v, 1, pp. 41–42, 1939.

Cultural studies by the author demonstrated that a mixed culture of *Penicillium digitatum* and *Oospora citri-aurantii* [*R.A.M.*, ix, p. 106] grew more rapidly than a pure culture of either. On a medium deficient in nitrogen, the latter fungus failed to grow alone, but when it was inoculated along with *P. digitatum* a colony developed comprising *O. citri-aurantii* as the dominant species, with a diameter at least four times that of the pure culture of *O. citri-aurantii*. Evidence was obtained that the filtrate of a liquid medium in which *P. digitatum* had been grown had the same ability, even after autoclaving, of stimulating the growth of *O. citri-aurantii*. The effect of the thermostable substance is most marked on a nitrogen-deficient medium, and the substance is therefore thought to be of the nature of a bios. *O. citri-aurantii* appears to be heterotrophic with regard to proteins, and to depend on some other organism for its supply of complex nitrogen compounds. *P. digitatum*, on the other hand, appears to be autotrophic in regard to protein supply, and the stimulatory substance to be a by-product in its nitrogen metabolism.

The fact that more rotting is caused in citrus fruits when these two fungi are present together than when only one is present is attributed to stimulation of *O. citri-aurantii* by some by-product of *P. digitatum*, and to the removal of some staling substance hindering the growth of the latter. This apparent case of synergism is also one of metabiosis, in which, however, the mutual effects of the two fungi are virtually simultaneous.

Kreibohm de la Vega (G. A.). **Improductividad del Algodonero. Un interesante caso de acromania o puntas locas ('crazy-top'), observado en dos lotes de Algodón en el Departamento de Trancas, provincia de Tucumán.** [Unproductiveness of Cotton. An interesting case of acromania or 'crazy top' observed in two Cotton stands in the Department of Trancas, Province of Tucumán.]—*Rev. industr. agríc. Tucumán*, xxviii, 4–6, pp. 127–133, 5 figs., 1938.

Attention is drawn to the occurrence of crazy top or acromania affecting 80 per cent. of the plants in two cotton [*R.A.M.*, xiv, p. 629] stands in Tucumán, Argentine Republic.

Andrews (F. W.) & Clouston (T. W.). **Section of Botany and Plant Pathology.**—*Rep. Dep. Agric. For., Sudan Govt, 1937*, Part II, pp. 32–46, 7 graphs, [? 1939].

In this report on plant disease work in the Anglo-Egyptian Sudan in 1936–7 [cf. *R.A.M.*, xvii, p. 521] the authors state that cotton blackarm [*Bacterium malvacearum*: ibid., xviii, p. 23] was generally distributed through the Gezira in the period in question, though severe infection occurred for the most part only in patches. The later sown fields had less disease than those sown earlier, and in many of the former infection was negligible or absent. In many instances the distribution of outbreaks showed no relation to the adjacent old cotton land; apparently the careful cleaning of the latter at the end of the picking season had removed large amounts of very infective material.

That in some fields infection was concentrated on the side nearest the old cotton land indicated that the cleaning up was executed with insufficient thoroughness in places. A search of the 1935–6 plots on the Gezira research farm resulted in the first infected volunteer seedling being found on 28th August, 1936, a record lateness of appearance since 1932. Late rains favoured spread, and the evidence indicated that the clean-up of infected debris had not been entirely successful.

All persons passing into the Wad Hilal area were searched for seed cotton and cotton sticks, but in spite of this precaution, a certain amount of cotton was brought in and later proved of much importance. Both in Wad Hilal and Fawar infection spread normally. It is clear that attempts to prevent the appearance of the disease in new areas are hopeless unless the introduction of cotton remains into such areas can be effectively stopped.

When sterilized cotton seed was sown in plots on which infected debris had been sprayed with 20 per cent. sulphuric acid, marked decrease in infection resulted as compared with the unsprayed controls. A liquid disinfectant (in the experimental stage as yet) mixed with the cotton seed and allowed to dry on it was more lethal to *Bact. malvacearum* than abavit B.

Leaf curl [ibid., xvii, p. 522] was present only to a very slight extent in the southern half of the Gezira, which had been planted with resistant X 1530 or X 1530A cotton.

The first outbreak of wilt [loc. cit.] definitely associated with the rotting of secondarily thickened roots occurred on 1st December, 1936. By the end of January, 1937, nearly 70 per cent. of the plants (X 1530) had wilted in the area studied on the Gezira research farm, recovery subsequently reaching nearly 100 per cent. Progress is reported in selecting resistant plants from a plot of X 1530 showing a high percentage of wilt.

Counts of wilting plants made early in January, 1937, on numerous plots undergoing a wide range of treatments indicated that local soil variations were more important in determining wilt incidence than experimental treatments, while during the season concerned X 1530 was more susceptible than Sakel. Fallowing reduced wilt incidence as compared with cropping with lubia [*Dolichos lablab*] or durra [*Sorghum vulgare*]. Increasing the number of plants per hole appeared to reduce wilt incidence, as did nitrogen applications.

Fungi isolated from discoloured fine roots of X 1530 and Sakel cotton included an unidentified fungus, referred to as 'XT' [loc. cit.], *Cylindrocarpon didymum*, *Macrophomina phaseoli*, a *Rhizoctonia* species near *R.* [*Corticium*] *solani* [ibid., xviii, p. 248], *Pythium afertile*, *P. proliferum*, and *P. gracile*. Isolations from rotting secondarily thickened roots included the 'XT' fungus, *Cylindrocarpon didymum*, L-47 type (*Rhizoctonia* group), *R.* sp. (near *Corticium solani*), *M. phaseoli*, and *P.* sp. The roots of both varieties from the later sowing appeared to contain more hyphae than those of the earlier, this observation being confirmed by the numbers of isolations obtained from the two sowings. Rotting of the thickened roots occurred erratically with the L-47 type fungus and *R.* sp. in several treatments, mainly in very moist soil given a heavy application of sterilized, rotted organic matter. Both fungi seem able

under pot conditions to produce a root rot sufficient to cause wilting and death of seedlings.

Investigation into the effect of soil conditions on root development showed that the root system of plants heavily watered was smaller and penetrated less deeply into the soil than that of plants lightly or moderately watered. The roots of the heavily watered plants showed considerably more fungal infection than the others. The fine-root systems of 'debudded' plants were almost twice the size of plants not 'debudded', the evidence indicating that the maturing of buds and bolls by the plants reduces the total mass of fine roots but does not affect depth of penetration. It is considered that the improved growth of cotton noted on land previously cropped with salt bush [*Atriplex*] may probably be associated with the deeper soil cracking found in salt bush plots (reaching 5 ft. 9 in., as against 3 ft. $2\frac{1}{2}$ in. in cotton plots).

A large proportion of *D. lablab* sown during the rains was attacked by *Bact. phaseoli*, but infection did not cause serious injury, and plants sown after the rains remained unaffected.

Good results were obtained by seed treatment against sorghum smut (*Sphacelotheca sorghi*) [ibid., xvii, p. 670; xviii, p. 18] with copper carbonate.

Other records include *M. phaseoli* causing a wilt of *Mucuna* sp., a wilt of broad beans [*Vicia faba*] from which *Fusarium moniliforme* [*Gibberella fujikuroi*] was the dominant isolation obtained, and a staining of cotton lint, with consequent loss of tensile length, due to *F. scirpi* var. *compactum*.

Brown (J. G.). **Cotton rust in Arizona.**—*Plant Dis. Reptr*, xxii, 19, pp. 380–382, 1938. [Mimeographed.]

True rust of cotton (*Puccinia schedonnardi*) [*R.A.M.*, xiv, p. 629] was unusually prevalent in southern Arizona in 1938, causing an estimated incidence of infection of 50 per cent. in certain areas. Outbreaks of the disease invariably start in the south and progress northwards. Poorly irrigated crops growing at slight elevations, as well as plants in an unthrifty and woody condition, are liable to escape infection. The chief spread of the disease occurs from 1st July to 1st August, after the commencement of the summer rains, the basidiospores transported by air germinating and producing infection only in the presence of sufficient moisture on the susceptible organs of the plants. The alternate grass hosts of *P. schedonnardi*, *Sporobolus* and *Muhlenbergia* spp., occur in the mountainous regions adjacent to the Santa Cruz cotton districts, and probably also in those of northern Mexico, but have not yet been observed in the rusted fields themselves.

Loewenthal (L. J. A.). **Diseases of the skin in negroes. IX–XIV. Fungi and fungous diseases.**—*J. trop. Med.* (*Hyg.*), xl, 24, pp. 324–327, 1937; xli, 2, pp. 21–26; 3, pp. 41–45; 4, pp. 58–64; 11, pp. 187–189, 1938; xlii, 2, pp. 20–25; 3, pp. 36–38; 4, pp. 53–57, 37 figs., 1939.

This is an informative, fully documented survey of the symptomatology, etiology, diagnosis, distribution, therapy, and other features of interest in connexion with fungal diseases of the skin in negroes.

Dowding (Eleanor S.) & Orr (H.). **The dermatophyte Microsporum lanosum.**—*Mycologia*, xxxi, 1, pp. 76–92, 25 figs., 4 graphs, 1939.

After stating that *Microsporon lanosum* [*R.A.M.*, xvii, p. 818] when producing non-inflammatory lesions may be clinically indistinguishable from *M. audouini* [ibid., xvii, p. 746; xviii, p. 177], the authors describe a mycological study made of a long-spored and a short-spored strain of the former isolated in Canada from two patients showing the same clinical type of ringworm. The microconidia were produced most abundantly in wet cultures, were released by the dissolution of the conidiophores, and collected in the moisture exuded by the aerial mycelium; they are evidently 'slime' spores [Mason's Annotated list: ii, Fasc. 3, 1937]. The macroconidia were set free by the rupture of certain cells termed abscission cells, and collected in the form of a powdery deposit over the surface of the culture; these were clearly 'dry' spores [loc. cit.]. The spore deposit became overgrown by a white, sheet-like secondary (usually termed pleomorphic) mycelium composed of narrow, almost sterile hyphae with characteristic thickenings in the form of thin plates or rings of irregular outline. While still young, the secondary mycelium could be restored to its original condition by transfer to fresh medium. Owing probably to uneven thickness of the cell walls the secondary mycelium readily fragmented into short lengths when mounted in water. Observations on 20-day-old cultures indicated that it usually originated from the base of the abscission cell after the spores were shed. A narrow hypha normally grew out through the plugged perforation of each bulging terminal septum. Formation of the secondary mycelium was induced experimentally by wounding the primary mycelium before the formation of the macroconidia.

Grigoraki (L.) & David (R.). **Caractères biochimiques du Microsporum canis (Bodin, 1897), Grigoraki et Guiart emend. 1928.** [Biochemical characters of *Microsporum canis* (Bodin, 1897), Grigoraki & Guiart emend. 1928.]—*C.R. Soc. Biol., Paris*, cxxx, 3, pp. 203–205, 1939.

Continuing their studies on the biochemical characters of the dermatophytes [*R.A.M.*, xvii, p. 818], the writers found that *Microsporon canis* [ibid., xvii, p. 819] acts powerfully and rapidly on casein at 20° C., the dissolution of which in sterilized skimmed milk commences on the third and proceeds until the 50th day, and on gelatine at the same temperature, liquefaction beginning on the second day and reaching a maximum on the 20th. The colours of the colonies (Klincksieck and Valette) after 30 days at 35° in the presence of mannose, glucose, galactose, maltose, saccharose, lactose, inulin, dextrin, and glycerine (15 c.c. per tube and a dozen drops of sterilized litmus) were orange-yellow 178D, orange 128D, reddish-orange 61, purplish-red 581, purplish-red 592, reddish-orange 78D, purplish-red 591, red 28D, and red 36, respectively.

MacKee (G. M.) & Lewis (G. M.). **Dandruff and seborrhea. I. Flora of 'normal' and diseased scalps.**—*J. invest. Derm.*, i, 2, pp. 131–139, 1938.

In this study (in which the writers were assisted by Martha J. Spence

and Mary E. Hopper) of the scalp flora of 100 patients in New York City, *Pityrosporon ovale* [*R.A.M.*, xvii, p. 597] was found to be present on 70 per cent. of the normal scalps and on 66 per cent. of those showing a concomitant skin disease. In the dry or oily, scaly scalps (with or without alopecia) the percentage incidence was almost uniformly 100.

MacKee (G. M.), Lewis (G. M.), Pinkerton (M. Elizabeth), & Hopper (Mary E.). **Dandruff and seborrhea. II. Flora of the face, and further studies on the flora of the scalp.**—*J. invest. Derm.*, ii, 1, pp. 31–41, 1939.

*Pityrosporon ovale* [see preceding abstract] was isolated from scrapings from the skin of the face and scalp in 52 per cent. of the 133 patients examined at the New York Post-Graduate Medical School, Columbia University.

Dickson (E. C.). **Primary coccidioidomycosis. The initial acute infection which results in coccidioidal granuloma.**—*Amer. Rev. Tuberc.*, xxxviii, 6, pp. 722–729, 1938.

The writer's observations on the origin and course of the primary phase of coccidioidomycosis (*Coccidioides*) [*immitis*] in the San Joaquin Valley of California have already been noticed from another source [*R.A.M.*, xviii, p. 179].

Epstein (N. N.) & Levin (E. A.). **Favus infection. Report of a case from California.**—*Urol. cutan. Rev.*, xlii, 7, pp. 515–517, 4 figs., 1938.

Clinical details are given of a case of favus in California in a 20-year-old girl of Russian–Jewish origin, who had been under observation for the previous six years, during which time the eruption gradually changed its appearance from discrete, scaly patches scattered over the scalp and suggestive of psoriasis or seborrhoeic dermatitis to the typical scutula formation with permanent alopecia and scarring associated with true favus. Onychomycosis was also present in the later stages. *Achorion schoenleini* was consistently isolated from the lesions on Sabouraud's media and gave rise to light brown, leathery colonies with chlamydospores and favic 'candelabra'.

Cavallero (C.). **Fenomeni di variazione e di dissociazione nei miceti lievitiformi.** [Variation and dissociation phenomena in the yeast-like fungi.]—*Mycopathologia*, i, 4, pp. 227–266, 3 pls., 1939. [English and German summaries.]

After reviewing previous investigations on variation and dissociation phenomena in yeast-like fungi, the author gives an exhaustive account of his studies made in this connexion with ten strains of *Mycotorula* [*Candida*] *albicans* [*R.A.M.*, xvii, pp. 676, 817; xviii, p. 253]. In culture, *C. albicans* gave rise to smooth and rough colonies differing in their morphological and biochemical characters, pathogenicity, and aspecific agglutinability. When the smooth strains were grown under unfavourable, and the rough ones under favourable, nutritive conditions some of the strains in each series developed smooth and rough colonies side by side, accompanied, irregularly, by changes in other

characters. Some strains showed variation phenomena independently of macroscopic cultural modifications towards the smooth or rough form. Dissociation was sometimes preceded by a striking polymorphism of the yeast cells. Intermediate forms occurred showing the characters of both the rough and smooth forms simultaneously. Dissociation was also induced by passage through laboratory animals. The author concludes that dissociation in the asporogenous yeasts is a reaction by the fungus to environmental factors; under unfavourable conditions, the fungus produces a preponderance of 'resistance forms', such as mycelium and chlamydospores, with the result that it tends to develop the R phase, while under favourable conditions, blastospores, characteristic of the S phase, are produced.

Croft (C. C.) & Black (L. A.). **Biochemical and morphologic methods for the isolation and identification of yeastlike fungi.**—*J. Lab. clin. Med.*, xxiii, 12, pp. 1248–1258, 1938.

The authors describe studies on methods for culturing yeast-like fungi and the significance of certain cultural criteria in their identification. On the basis of the results obtained, supplemented by morphological criteria, it was possible to separate yeast-like fungi into genera and in some cases into species. Nine of the 13 strains isolated from pathogenic conditions (mostly in sanatorium patients) were identified as *Monilia* [*Candida*] *albicans* [see preceding abstract], which gave the most consistent fermentation results of any of the cultures studied, producing acid and gas in dextrose, levulose, mannose, and maltose, and acid in saccharose, galactose, and dextrin.

Verona (O.) & Ciferri (R.). **Mycotorula albicans associated with a disease of Carrot.**—*Mycopathologia*, 1, 4, p. 273, 1939.

The authors report the occasional isolation of a normal strain of *Mycotorula* [*Candida*] *albicans* [see preceding abstracts] from rotted carrots naturally infected with *Sclerotinia sclerotiorum* and *Bacillus carotovorus* [*Erwinia carotovora*] in Italy.

Giordano (A.). **Studio micologico del Debaryomyces neoformans (Sanfelice) Red., Cif. et Giord. e significato della specie nella patologia animale.** [A mycological study of *Debaryomyces neoformans* (Sanfelice) Red., Cif. & Giord. and of the significance of the species in animal pathology.]—*Mycopathologia*, i, 4, pp. 274–304, 2 pl., 1939. [English summary.]

After briefly reviewing previous taxonomic studies which led to the establishment of *Debaryomyces neoformans* [*R.A.M.*, xvi, p. 534; xvii, p. 111; xviii, p. 29], the author gives a detailed account of cultural, morphological, biochemical, and biological investigations into 28 strains of the organism in culture under several binomials. From the results of his study the author lists 68 species as synonyms, including *Torula histolytica*, *Torulopsis hominis*, *Cryptococcus hondurianus* [ibid., xiii, p. 162], *C. psichrofilicus* [ibid., xvi, p. 534], *T. hominis* var. *honduriana*, *T. neoformans* [cf. ibid., xvi, p. 254], *T. meningitidis*, *C. gotoi* [ibid., xvi, p. 534], and *D. hominis* [ibid., xv, p. 802]. *D. neoformans* var.

*sheppei* [ibid., xiv, p. 694] and *D. neoformans* var. *nasalis* [loc. cit.] are recognized as distinct from the type species.

The fungus is described as having globose or subglobose, occasionally ovate or elliptical blastospores, 3 to 11 (mostly 7 to 11), occasionally up to 18$\mu$, in diameter. In some strains uni-, occasionally bi-spored asci develop parthenogenetically. The spherical ascospores are generally smooth, and sometimes have an undulating verrucose epispore. Germination takes place with the formation of a short germ-tube resembling a blastospore. Traces are present of the conjunction of isogamous gametes; the asci dehisce through the fracture of the wall, and the empty walls are visible in old cultures. Biochemical activity is very slight; glucose, levulose, mannose, and saccharose, but not maltose, are assimilated with the formation of acid; gelatine is not liquefied.

When inoculated into laboratory animals all 28 strains produced morphologically identical lesions. All were pathogenic, but specific granulomatic lesions were produced only in the meningeal and cerebral tissues of rats, these lesions being analogous to those observed in man.

Magruder (G.). **A report of three cases of Torula infection of the central nervous system.**—*J. Lab. clin. Med.*, xxiv, 5, pp. 495–499, 1939.

Full clinical details are given of three cases (two in coloured women and one in a white man) of infection of the central nervous system by *Torula histolytica* [*Debaryomyces neoformans*: see preceding abstract] investigated at the University of Virginia Hospital in 1936 and 1937, and bringing the total to 66.

Itzerott (Dorothea). **Ein Fütterungsversuch an Meerschweinchen mit Maisbrandsporen.** [A feeding experiment with spores of Maize smut on Guinea-pigs.]—*Z. PflKrankh.*, xlix, 1, pp. 40–41, 1939.

Feeding experiments with maize straw contaminated with smut [*Ustilago zeae*: *R.A.M.*, xviii, p. 18] are described. Guinea-pigs carrying young were given for six to eight weeks a daily ration of either 0·2 gm. old or 0·3 gm. fresh smut spores mixed with their food, and in all cases a normal litter was born. It is probable that cows and horses are similarly not affected by the smut.

Ocfemia (G. O.) & Celino (M. S.). **Transmission of Abacá mosaic.**—*Philipp. Agric.*, xxvii, 7, pp. 593–598, 1938.

In Davao, Philippine Islands, mosaic disease of abacá (*Musa textilis*) [*R.A.M.*, xviii, p. 256] may, it is considered, if further spread is not arrested, become as serious from an economic point of view as bunchy top [loc. cit.]. In August, 1937, fully 50 per cent. of the plants were affected in some localities.

In transmission experiments in 1937–8, *Pentalonia nigronervosa* failed to transmit the disease, but successful transmission was obtained in all tests with two [unnamed] species of aphids found on abacá and banana. Transmission was also effected when the wounded surface of the midrib of a diseased abacá plant was allowed to remain in contact with the wounded surface of the midrib of a healthy one for 28 days, but inoculations by pin-pricks and sap injection were inconclusive. When cotton aphids (*Aphis gossypii*) were allowed to feed for two weeks on a

mosaic abacá plant and then transferred to a healthy abacá seedling, mosaic symptoms developed after 18 days. Similar results were obtained in a further test with three other healthy abacá seedlings in 15 to 22 days, while in another test mosaic symptoms were induced by infective *A. gossypii* on abacá plants in 24 days and on wild *Canna* plants in 18 days.

In the aphid transmission experiments, the first symptom consisted in light-coloured, dot-like areas, ½ to 1 mm. in diameter, on the first leaf to unfurl after the insects had been allowed to feed. These yellow areas expanded very rapidly until arrested by the veins, and formed oblong, discoloured areas, from 3 to 15 mm. (or even to the leaf margin) by 1 to 1½ mm., the site of the original spot remaining distinct in all cases. On the succeeding leaves the symptoms gradually became more marked, until the whole foliage sometimes turned yellow. The symptoms on wild *Canna* were virtually the same, though the streaks appeared about 20 days after the first symptoms.

Lopatin (V. I.). Болезни Люцерны и меры борьбы с ними. [Diseases of Lucerne and their control.]—*Socialistic Grain Fmg, Saratoff, 1938*, 2, pp. 110–128, 13 figs., 1938.

The extensive spread and frequent severity of lucerne rust (*Uromyces striatus*) [see above, p. 375] in the German S.S.R. of the Volga, as well as on the left bank of the middle reaches of that river, is attributed by the author chiefly to the abundance in those regions of highly susceptible species of *Euphorbia*, i.e., *E. virgata*, *E. uralensis*, and possibly *E. esula*. Even in 1936, when conditions were exceptionally dry and hot, rust infection in irrigated lucerne fields was as high as 32·6 per cent., though slight to very slight elsewhere; in 1937, which was marked by wet and cool conditions during the later part of the spring, the percentage of infection attained 89·3 in the irrigated, and 80·3 in the non-irrigated areas; in dry-cultivated fields, however, which had been free from rust in 1936, infection fell to 12·9 per cent. on the Ukrainian 229 variety and to 1·94 per cent. on the local [unnamed] variety. The effect of density of lucerne stands on the spread of rust from infected *Euphorbia* plants was well illustrated by the fact that in the thinner stands of 1936 infection was still 10·7 per cent. at a distance of 0·8 to 1 m. from the source of infection, while in the dense stands of 1937 no infection was noted at a distance of 0·5 m. Evidence is further adduced showing that in fields only slightly attacked, the percentage infection rose to 50 on plants that had been mechanically injured during cultivation. Preliminary observations on rust resistance indicated that varieties native to Asia Minor and Central Asia are highly susceptible, while certain samples received from Canada and the United States were highly resistant. Certain ecological types from east China (Yangi-Shar and Kashgar) were also very resistant, and might be used in hybridization work for rust resistance.

The other lucerne diseases in the regions studied in the two years are stated to be: brown spot (*Pseudopeziza medicaginis*) [*R.A.M.*, xvii, p. 325], leaf spots caused by *Cercospora medicaginis* [ibid., ix, p. 319], *Ascochyta pisi* [ibid., xvii, p. 831], *Leptothyrium coronatum* (a new record for the region), *Phyllosticta medicaginis* [ibid., xiii, p. 32], and *Guignardia*

sp.; downy mildew (*Peronospora aestivalis* [or *P. trifoliorum*; ibid., xi, p. 304]); black stem spot (*Sphaerella circumvaga*), *Corticium vagum* [*C. solani*], and a black leaf spot caused by an unidentified fungus, which is stated to induce heavy defoliation in affected stands.

**Plant diseases. Notes contributed by the Biological Branch.**—*Agric. Gaz. N.S.W.*, l, 2, pp. 87–90, 1939.

In several districts in the west of New South Wales during 1937–8 lucerne stands developed vast unhealthy patches in which individual plants turned yellow and died, the crown and root tissues rotting and having a shredded, greyish appearance. Both two-year-old stands and others established for several years were affected, the diseased areas being more prevalent on light than heavy soils. It was ascertained that the chief factor inducing the trouble was over-stocking in an exceptionally dry season, with consequent weakening, and resultant infection by *Rhizoctonia bataticola* [*Macrophomina phaseoli*: *R.A.M.*, vii, p. 674].

Black rot of stocks [*Matthiola incana* var. *annua*], attributed to a strain of *Bacterium campestre* [*Pseudomonas campestris*: ibid., xviii, p. 256], is stated to have caused a loss of 12,000 seedlings in one nursery alone. The control methods suggested consist in the selection of clean seed, steeping for 10 minutes in mercuric chloride ($\frac{1}{4}$ oz. to $12\frac{1}{2}$ pints of water), soil disinfection with formalin (1 in 50) a few weeks before sowing, planting out the seedlings on clean areas, crop rotation, and the destruction of diseased plants.

Wormald (H.). **Diseases of Fruits and Hops.**—290 pp., 40 pl., 24 figs., London, Crosby Lockwood & Son, Ltd., 1939. 17*s.* 6*d.*

This well illustrated book is written mainly for growers, but intended to be of use also to students and advisers in horticulture. After preliminary chapters dealing with factors conducive to health or disease in plants, fungicides and their application, and certain diseases affecting several different hosts, the author gives an account in semi-popular terms of the diseases of fruit trees (including walnut and cob nut [*Corylus avellana*]) and hops in Great Britain. Symptoms and control measures are stressed, but brief descriptions are given of the parasites and their habits. A final chapter is devoted to some of the more important diseases of fruit trees not yet recorded in this country.

Banga (O.). **Handleiding voor het herkennen van eenige nietparasitaire ziekten en beschadigingen van Appels.** [A guide to the recognition of some non-parasitic diseases and injuries of Apples.]—*Meded. Lab. Tuinbouwpl., Wageningen*, 31, 49 pp., 29 figs., 1938.

In this useful guide the non-parasitic disorders of apples [cf. *R.A.M.*, xviii, pp. 116–119) under discussion are divided into six groups, viz., (I) diseases and injuries induced by climatic influences during vegetation, including water-core; (II) boron deficiency; (III) pitting; (IV) physiological disturbances after picking, practically restricted to the skin, e.g., scald, lenticel scald, Gravenstein spot scald, and Jonathan spot; (V) brown discoloration of the flesh during storage, including low temperature or soggy breakdown, of which soft or deep scald is a special form, brown heart, and Jonathan breakdown; and (VI) injuries due

to chemicals or gases. The symptoms, etiology, predisposing factors, and possibilities of control are briefly described in connexion with the various diseases, and a bibliography of the relevant literature is appended to each section.

Schmidt (M.). **Venturia inaequalis (Cooke) Aderhold. VIII. Weitere Untersuchungen zur Züchtung schorfwiderstandsfähiger Apfelsorten. (Erste Mitteilung.)** [*Venturia inaequalis* (Cooke) Aderhold. VIII. Further investigations on breeding scab-resistant varieties of Apples. (First note.)]—*Züchter*, x, 9–11, pp. 280–291, 6 figs., 1938.

In this contribution to his studies on apple scab (*Venturia inaequalis*) [*R.A.M.*, xvi, p. 617] the author describes the results of six years' observations on the resistance to scab of 31 species or hybrids of *Malus* [*Pyrus*] grown at Müncheberg, Mark Brandenburg, Germany. In the field no infection occurred on *M.* [*P.*] *coronaria* or *M.* [*P.*] *micromalus*, and little on *M.* [*P.*] *spectabilis*, *M.* [*P.*] *zumi*, *M. ioensis* var. *plena*, *M. lancifolia*, and *M. hartwigii*. In other field tests resistance was found in 20 seedlings out of 887 from open-pollinated species of *Pyrus*, in 8 out of 901 crosses between *Pyrus* spp., 4 out of 3,873 crosses between *Pyrus* forms and cultivated apple varieties, and 1 seedling of Landsberg Pippin (No. V, 9, 18) out of 21,616 from open-pollinated cultivated varieties; most of these seedlings proved to be resistant under conditions of artificial infection to populations of the fungus from five different origins. The majority, however, bore small fruits with a high tannin content. Of the Müncheberg collection of apples Stein Antonovka showed no infection at all, Antonovka Kamenitzka only a little, and Ernst Bosch was relatively less susceptible than most of the other varieties.

In further work one-year-old seedlings were tested by inoculations on individual plants or in the mass. The latter method consisted in sprinkling the seedlings in a whole row of seed-beds with a suspension of conidia, covering the beds with cloth, and keeping them moist for three or four days. In the first series of experiments 14 out of 178 seedlings from crosses between open-pollinated *Pyrus* spp. and cultivated varieties were found to be resistant, all of them having *M. baccata* var. *himalaica* (No. V, 35, 16) (found to be resistant in the field) as one of the parents. In a further series the progenies of the *P. micromalus* × Charlamowsky (No. II*b*, 7, 32) gave the best results, showing 18 resistant seedlings among the 40 tested. Of 1,638 progenies of Antonovka tested 163 were resistant, and of 168 progenies of Ernst Bosch six. A general survey of the results showed that the highest percentage of resistant forms (4·1 per cent.) was among the progenies of *P.* spp. and their hybrids, 2·6 per cent. among the crosses between *P.* spp. and cultivated varieties, and 1·9 per cent. among the backcrosses of the hybrids of *P.* spp. × cultivated varieties to cultivated varieties.

Hildebrand (E. M.). **Studies on fire-blight ooze.**—*Phytopathology*, xxix, 2, pp. 142–155, 4 figs., 1939.

Virulent cultures of the causal organism of fireblight (*Erwinia amylovora*) [*R.A.M.*, xvii, pp. 535, 660; xviii, p. 36] were recovered

from various samples of dried natural exudate collected in the orchard [? at Cornell, New York] on Northern Spy apples and several pear varieties after periods ranging from 15 to 25 months, whereas in pure culture the pathogen does not ordinarily survive desiccation even for one.

The material used in most of these studies was obtained by the aseptic inoculation of green pear fruits, each of which yielded about 1 c.c. moist exudate, turbid at first but tending to clear with advancing age and rapid death of the bacteria. The survival of the latter for more than a fortnight (a maximum of five months in these tests) in their natural matrix necessitates prompt drying (within a week of collection). The colour of the exudate is a uniform cinnamon-rufous-brown. Chemical analyses showed that a sugar identified as dextrose comprises 31 per cent. of the dry substance in the matrix. The thermal death point of the bacteria contained in pear exudate was found to be lower by about 5° C. than that of the organisms grown on agar or in broth. In its natural matrix *E. amylovora* was also more sensitive to the action of bactericides than on culture media. Cultures of the organism on a synthetic carbohydrate medium were able to utilize the dilute sterile exudate as a source of carbon. The fireblight bacteria stain unevenly with carbol fuchsin when embedded in their natural matrix; they were shown by this means to be surrounded by a capsule-like sheath removable by high-speed centrifuging in water or physiological salt solution.

Dilute fireblight exudate with an osmotic pressure of 1·61 atmospheres induced wilting of pear shoots and cellular plasmolysis, whereas in pure sucrose solutions osmotic pressures of 15·62 atmospheres and upwards were required to bring about similar effects, indicating the operation in the exudate of some factor other than osmotic pressure. Wilting developed in cut pear shoots immersed in sterile exudate matrix, pointing to the presence of a toxin. The wilting was accompanied by necrosis of the cut ends and plasmolysis of the cells in the lower portions of the stem. The toxic substance of the exudate is thermostable, withstanding steam heat for several hours and three months in the dry-air oven at 100° C, but its exact identity remains to be determined.

MOORE (W. C.). **New and interesting plant diseases. I.**—*Trans. Brit. mycol. Soc.*, xxii, 3–4, pp. 264–267, 1 pl., 1939.

The angular spot disease of apples observed in 1937 at Lingfield, Surrey [*R.A.M.*, xvii, p. 373] is attributed to *Phyllosticta angulata* on the basis of careful comparison of the English material with that collected in Austria by Wenzl [ibid., xv, p. 814]. The constant association of the fungus with these very angular spots strongly suggests that it is the cause of the disease, but no confirmatory experiments have yet been carried out. On the host the pycnidia were 90 to 170 $\mu$ in diameter, the unicellular, hyaline spores measuring 6 to 8 by 3 to 4 $\mu$. Monospore isolations on malt agar gave a whitish-grey to buff-coloured felt of mycelium with relatively abundant pycnidia, the larger of which were up to 280 $\mu$ in diameter, and with rather longer and broader spores measuring 5 to 9 by 4 to 6 $\mu$.

*Haplobasidium pavoninum* was isolated from the conspicuous, irregularly shaped, buff-coloured blotches, about ¼ to 1 in. across, spreading inwards from the margins of the leaves of a seedling *Aquilegia* from a garden at St. Keverne, Cornwall. Some of the leaflets were killed and in others a well-marked purplish band indicated the boundary between the healthy and diseased parts. The conidiophores emerging through the cuticle were simple, smoke-grey, 24 to 45 μ long and 4 to 7 μ broad at the base, swelling above to a rounded, flattened head 11 to 15 μ across, on which 1 to 4 (mostly 3) sterigma-like cells, measuring 15 to 18 by 5 to 6 μ, were borne. The conidia were formed in short chains on the sterigma-like cells or directly on the head of the conidiophore and were spherical or ellipsoidal, hyaline at first, then greyish-brown, 7 to 11 by 6 to 9 μ, with a clearly defined wall ½ μ thick.

Buckstеeg (W.). **Über die Monilia-Anfälligkeit unserer Obstsorten.** [On the susceptibility of our fruit varieties to *Monilia*.]—*Z. Pfl-Krankh.*, xlix, 1, pp. 11–15, 1939.

The author gives a list of 47 varieties of cherry, 46 of apple, and 51 of pear classified according to their reaction to *Monilia* [*Sclerotinia* spp.]. The resistant cherry varieties include Beste Werder, Excellenz von Hindenburg, Flametin, Grosse Prinzessin, Hedelfinger Riesen, Jaboulay, Kassin's Frühe, Königliche Amarelle, La Poitevine, Liefeld's Braune, Lübeck Wein, Schöne von Montreuil, and Wils' Frühe Herz; and the resistant apple varieties Ananas Renette, Baumann's Renette, Echter Winterstreifling, Gelber Bellefleur, Glanz-Renette, Grosser Bohnapfel, Grüner Winter Stettin, Jakob Lebel, Nathusius' Taubenapfel, Parker's Pippin Sommer-Zimtapfel, and Roter Trierischer Weinapfel. The list of resistant pear varieties is based solely on observations by Klöck in 1910 (*Z. landw. VersWes. Öst.*, xiv, 3, 1911).

Gonçalves (R. D.). **A sarna e a podridão parda do Pessegueiro.** [Scab and brown rot of the Peach.]—*Biologico*, v, 1, pp. 17–18, 1939.

Popular notes are given on two widespread and destructive diseases of peaches in Brazil, namely, scab (*Cladosporium carpophilum*) and brown rot (*Sclerotinia cinerea*) [*S. laxa*], with directions for their control by appropriate cultural measures and the application of a standard spray schedule.

Hildebrand (E. M.) & Palmiter (D. H.). **Yellow-red virosis (X-disease) of Peach and Chokecherry.**—*Plant Dis. Reptr*, xxii, 20, pp. 394–396, 1 map, 1938. [Mimeographed.]

Further details are given concerning the distribution of X-disease of peaches (for which the name of yellow-red virosis is now suggested as more descriptive) in New York [*R.A.M.*, xviii, p. 38]. Infected peach orchards have been definitely observed in Columbia, Greene, and Dutchess counties and are believed to be present also in Rensselaer and Albany, while diseased chokecherries (*Prunus virginiana*) have been detected in about 20 other counties, including some in the west and central sections of the State where the bulk of the peaches are grown. The yellow-red virosis is believed to have been present in the Hudson Valley for some time, possibly as long as four years. Particulars

are given of its rapid spread in two peach orchards, in which recent counts disclosed 65 and 41 per cent. infection, respectively. *P. virginiana* has further been observed by Prof. Whetzel to show symptoms of the disease in Vermont, while material of the western chokecherry (*P. demissa*) from Utah was similarly affected. The typical features of yellow-red virosis are also reported on an isolated peach tree in Colorado.

Bauer (R.). **Die Methode der Masseninfektion bei der Züchtung meltau- und blattfallresistenter Rassentypen bei der Gattung Ribes.** [The mass infection method in the breeding of mildew- and leaf fall-resistant race types in the genus *Ribes*.]—*Forschungsdienst*, vi, 12, pp. 575–584, 3 figs., 1938.

Particulars are given of a combined mass infection method (by spraying with spore suspensions under controlled conditions) permitting the simultaneous greenhouse testing of *Ribes* spp. for resistance to mildew (*Sphaerotheca mors-uvae*) and leaf fall (*Gloeosporium ribis*) [*Pseudopeziza ribis*]. The process occupies a period of three to four weeks and facilitates the selection of individuals resistant to either or both of the diseases in question.

Rietsema (I.). **Oplossing van het mozaïek-vraagstuk bij de Frambozen.** [Solution of the mosaic problem in Raspberries.]—*Landbouwk. Tijdschr., Wageningen*, li, 620, pp. 14–25, 1939. [English summary.]

The writer describes further promising steps in his programme for the development of mosaic-resistant raspberries in Holland [*R.A.M.*, xvi, p. 475] by the protracted selfing of healthy seedlings of desirable varieties coupled with judicious crossing with 112 or Pyne-Royal and Haagsche Bruine or Lloyd George to avoid a weak habit of growth. The extended application of these methods should bring the mosaic problem well within sight of solution.

Edwards (W. D.) & Zeller (S. M.). **Insect pests and diseases of Strawberry in Oregon.**—*Bull. Ore. agric. Exp. Sta.* 357, 30 pp., 19 figs., 1938.

Popular notes are given on the following diseases affecting the Oregon strawberry crop: crinkle [*R.A.M.*, xiii, p. 313; xviii, p. 326], to which the Redheart variety is resistant; yellows [? xanthosis: ibid., xviii, p. 191]; witches' broom [ibid., viii, p. 295]; leaf spot (*Mycosphaerella fragariae*: ibid., xviii, p. 191]; scorch (*Diplocarpon earliana*) [loc. cit.] and leaf blight (*Dendrophoma obscurans*) [ibid., x, p. 254]; mildew [*Sphaerotheca humuli*: ibid., xviii, p. 191]; crown rot (*Armillaria*) [*mellea*: ibid., xi, p. 727]; root rots (*Rhizoctonia* [ibid., xvi, p. 822] and *Verticillium* [ibid., xvii, p. 689]); and fruit rots, chiefly grey mould (*Botrytis*) [*cinerea*: ibid., xviii, p. 191].

Wilcox (Marguerite S.). **Phomopsis twig blight of Blueberry.**—*Phytopathology*, xxix, 2, pp. 136–142, 2 figs., 1939.

Young, succulent blueberry (*Vaccinium corymbosum*) shoots reacted positively to greenhouse inoculations both with a *Phomopsis* isolated from diseased material of the same host in Massachusetts and with

*P.* (*Diaporthe*) *vaccinii* from decayed cranberry fruits [*R.A.M.*, xi, p. 188], no matter whether the inoculations were carried out with spore suspensions or with mycelium on wounded and unwounded tissues. The organisms gain ingress near the shoot tips and proceed downwards, at an average rate of 5·5 cm. in two months, eventually girdling the old branches and killing the part above. Direct inoculation of the woody tissues results in the formation of localized lesions only. Foliar spots bearing pycnidia developed at a relatively low temperature in the partial shade of a lath house, but not under normal greenhouse conditions. Pycnidia have also occasionally been found on dead twigs of Pioneer, Cabot, Wareham, Rubel, Rubel × Chatsworth, and Rubel × Haines in Massachusetts, and on Rancocas and Rubel in New Jersey. The disease has further been reported from North Carolina.

No essential differences were detected between the blueberry *Phomopsis* (which must not be confused with a species of the same genus causing crown and stem galls [ibid., xvii, p. 403]) and *D. vaccinii* in cultures on Thaxter's, beef, strawberry, maize meal, and potato dextrose agars at 10°, 18°, and 25° C. The pycnospores of both strains measured 6 to 11 by 2 to 5 μ and scolecospores were abundantly produced on certain media. The blueberry *Phomopsis* is considered, on the basis of these results, to be identical with *P.* (*D.*) *vaccinii* from cranberry.

Wilson (J. D.) & Runnels (H. A.). **Influence of residue color of Bordeaux mixture on transpiration in sun and shade.**—*Bi-m. Bull. Ohio agric. Exp. Sta.*, xxiii, pp. 129–138, 1 graph, 1938.

In further experiments on the effect of Bordeaux mixtures on the transpiration of plants [*R.A.M.*, xiv, p. 708] the authors studied the relation of spray residues of different reflective capacity to the transpiration rate in sun and shade. Tests were made on *Coleus*, tomato, potato, tobacco, and cucumber plants sprayed with Bordeaux mixtures of the following formulae: 4–4–50, 4–12–50, and 4–4–50 plus lampblack (4 lb.). Leaf temperature determinations showed the leaves of all plants to be warmer than the air when in full sunlight; those treated with the 4–12–50 mixture (with a light-coloured, opaque residue) were cooler, and those treated with the lampblack mixture warmer than the untreated ones, while the 4–4–50 residue had little effect on leaf temperature. The leaves of plants in the shade were usually slightly cooler than the air, except those sprayed with the lampblack mixture, and from 2° to 5° C. cooler than comparable ones in the sun. In the greenhouse, where the radiant energy factor was only about half as much as in full sunlight, transpiration was decreased by the residues from a 3–4½–50 and a 3–9–50 Bordeaux mixture but increased by a 3–4½–50 plus 3 lb. lampblack, between the hours of 10 a.m. and 4 p.m., the effect of lampblack on transpiration being at a maximum during the period of maximum sunlight intensity (from 10 a.m. to 1 p.m.). The lampblack mixture caused a greater increase in the transpiration rate of plants in full sunshine than in the shade, whereas the 4–12–50 mixture caused plants to lose less water in full sunshine than any of the other groups.

Data from 14 trials with *Coleus* and 10 with tomatoes showed that the plants in the shade lose approximately 60 per cent. as much water

as those in full sunlight. Cutting off two-thirds of the radiant energy by shade reduced the average transpiration rates in the sun for plants sprayed with the 4–4–50, 4–12–50, and the lampblack mixtures, and for untreated plants by about 40, 39, 40, and 42 per cent., respectively.

Dodge (B. O.). **The ascocarp and ascospore formation in Stevensea wrightii.**—*Mycologia*, xxxi, 1, pp. 96–108, 2 figs., 1939.

In an introductory paragraph to this paper the author states that he observed a very rapid, somewhat soft rot on segments of *Opuntia amophila* recently received from Florida. Within a week after the first appearance of the spots the segments had become thoroughly rotted, and hundreds of pustules were breaking through the surface and forming masses of crescent-shaped, uniseptate spores. Both the symptoms and the spore characters agreed with *Gloeosporium lunatum* (*Mycosphaerella opuntiae*) [ibid., v, p. 303]. No other disease of *Opuntia* studied by the author has so rapidly destroyed the segment.

The same material also bore spots containing the coal-black fruit bodies of a fungus referred to *Stevensea wrightii* (syn. *Perisporium wrightii*), previously studied by Wolf (*Ann. mycol., Berl.*, x, pp. 113–114, 1912). Cytological studies on this fungus are described in detail.

Suit (R. F.) & Horsfall (J. G.). **A simple method of measuring the interfacial friction of dusted seeds.**—*Phytopathology*, xxix, 2, pp. 200–204, 1938.

A simple but reliable method of measuring the interfacial friction of dusted seeds is described. A $\frac{1}{2}$ in. wooden plunger is thrust into a 300 c.c. tall beaker full of seeds (250 gm. of peas or wheat, 84 gm. beet) sitting on a spring-type platform household scales reading up to 24 lb., and the interfacial friction measured in pounds pressure required to push the plunger 3 in. into the seed by the indicator needle. The accumulated data of nine months revealed a marked increase of interfacial friction in peas from the addition of equal dosages of red copper oxide, 2 per cent. ethyl mercury chloride, and ethyl mercury phosphate (new improved ceresan). Both dusted and non-dusted Wilt Resistant Perfection peas showed more interfacial friction than Wisconsin Early Sweet. Flake graphite [*R.A.M.*, xvi, p. 720] of 325 mesh more effectively reduced the interfacial friction than amorphous graphite of the same particle size. Copper carbonate caused a greater increase in interfacial friction of Forward wheat seeds than red copper oxide, while a 30 per cent. rise followed the use even of the low concentration of new improved ceresan recommended for this cereal. Red copper oxide, semesan, and zinc oxide enhanced the degree of interfacial friction in beet seed; in the case of the first-named a slight reduction was effected by the incorporation of graphite with the dust.

Lambert (E. B.). **A spore isolator combining some of the advantages of the La Rue and Keitt methods.**—*Phytopathology*, xxix, 2, pp. 212–214, 1 diag., 1939.

A single spore isolator uniting the advantages of the La Rue (*Bot. Gaz.*, lxx, pp. 319–320, 1920) and Keitt (*Phytopathology*, v, pp. 266–269, 1915) techniques is described. It consists essentially of a 'biscuit cutter',

3 to 4 mm. in diameter, mounted vertically in a threaded brass plug, screwed on the microscope instead of the objective. The cutter, after flaming, is swung by the revolving nose-piece of the microscope into position above a single spore on agar in a Petri dish, moved downwards until a circle is marked off round the spore, and then raised and swung to one side. After examination of the circled area the cutter is again swung into place and lowered sufficiently to pick up the disk of agar with the single spore. The disk can be forced out of the cutter by lowering it into sterile agar and may then be transferred by a sterile microspatula to a dish or tube.

McLean (R. C.). **Isolating fungus spores.**—*Watson's micr. Rec.*, 46, pp. 3–4, 1 fig., 1939.

The author describes two improved types of cutter plunger, attachable to the nose-piece of a microscope, for cutting out portions of agar bearing single spores. One type is fitted with a safety spring, and both are supplied with a closely fitting ramrod for pushing out the agar by air compression.

Wilkins (W. H.) & Patrick (Sheila H. M.). **The ecology of the larger fungi. III. Constancy and frequency of grassland species with special reference to soil types.**—*Ann. appl. Biol.*, xxvi, 1, pp. 25–46, 1939.

In this third contribution to the series of papers on the ecological distribution of the larger fungi [*R.A.M.*, xviii, p. 2], the authors present the data on the 172 species of fungi found during 1936–7 in 20 different grassland stations on chalk, clay, and sand soils. Detailed notes are given on the ecology of each station and the fungi found are listed with their respective frequency. The number of species found on grasslands was small compared with those in oak and beech woods; only 86 species were common to grasslands and oak woods (469 species) and 70 to grasslands and beech woods (419 species). Grasslands are regarded as one ecological type in spite of soil variation.

Ingold (C. T.). **Spore discharge in land plants.**—178 pp., 75 figs., Oxford University Press, 1939. 7*s.* 6*d.*

This is a comprehensive survey of the varied methods of spore discharge by fungi and other cryptogams. The mechanisms of discharge, which are often of a very beautiful and intricate nature, are described in detail and illustrated by numerous drawings.

Wood (Jessie I.) **Crop losses from plant diseases in the United States in 1937.**—*Plant Dis. Reptr, Suppl.* 108, pp. 95–131, 1938. [Mimeographed.]

Tables are given showing the estimated reductions from fungal, bacterial, virus, and other diseases in cereal, vegetable, fruit, cotton, and tobacco crops in the United States in 1937 [cf. *R.A.M.*, xvi, p. 826].

Bawden (F. C.). **Some recent work on plant viruses.**—*Emp. J. exp. Agric.*, vii, 25, pp. 1–10, 1939.

In this survey of recent work on plant viruses the author discusses the

nature of viruses, symptoms of virus diseases, vectors, control, viruses as antigens, and the chemical nature and isolation of plant viruses.

RAYNER (M. C[HEVELEY]). **The use of soil or humus inocula in nurseries and plantations.**—*Emp. For. J.*, xvii, 2, pp. 236–243, 1938.

In September, 1937, the Imperial Forestry Institute, Oxford, sent a questionnaire to 47 representative Forestry Departments and Research Institutions in the British Empire and elsewhere inviting information on the mycorrhizal problem [cf. *R.A.M.*, xvii, p. 421] respecting the use of transported soil or humus in growing exotic trees.

Among the replies received, one from the Union of South Africa reported undeviating success with nursery and *in situ* sowings of exotic conifers always associated with satisfactory mycorrhizal development.

In India, *Casuarina equisetifolia* plants grown in inoculated soil were reported to have flourished, whereas the controls had died in three years.

In Northern Rhodesia, among *Pinus canariensis*, *P. caribaea*, *P. halepensis*, *P. pinaster*, *P. palustris*, *P. patula*, *P. taeda*, *P. teocote*, and other exotic species, it was found that only *P. halepensis* made any growth beyond the seedling stage without the addition of soil inocula. A striking stimulation of growth in nursery-beds of *P. longifolia* and experimental plots of *P. caribaea*, *P. halepensis*, and *P. taeda* followed inoculation with soil from a *P. radiata* plantation in Southern Rhodesia, but the treatment produced no visible effect in experimental plots of *P. pinea*, *P. pinaster*, *P. canariensis*, and *P. longifolia*. When nursery beds of *P. longifolia* were inoculated with soil containing mycelia and sporophores of different Hymenomycetes, after four months the untreated control seedlings and those from beds treated with soil containing the white edible mushroom 'tente' or with cow manure dug in on the surface averaged 3 in. in height, had short, discoloured needles and showed no mycorrhiza. The seedlings from beds treated with Southern Rhodesian soil averaged 5½ in. high, had long needles of good colour, and showed copious mycorrhiza.

The Buitenzorg (Java) Forest Research Institute reported that *P. merkusii* was entirely dependent on the presence of a mycorrhizal infection for normal development. After inoculation with humus from under pine, or with roots, or with pure cultures of the mycorrhizal organism, the plants closest to the place where the inoculation was effected displayed vigorous, normal growth. After the mycorrhiza had become established, infection spread rapidly. The chief mycorrhizal fungus of *P. merkusii* is a form of *Boletus granulatus* [ibid., xvi, pp. 155, 827] or some closely related species.

Nyasaland reported positive results following soil inoculation from old thriving stands of *P. patula* and *P. radiata* on many other species in nurseries and pots. All the species observed except *P. longifolia* failed to grow without soil inoculation, as did *Araucaria cunninghamii*.

New Zealand reported positive results for *P. radiata* using inoculation of seed beds with *Boletus*-infected soil from a healthy stand, and with sporophores of *B. luteus*, *Scleroderma bovista*, and *Rhizopogon rubescens*. Mycorrhiza were absent from plants in all control plots. Reports of successful inoculation were also received from Western Australia and Queensland [ibid., xvi, pp. 155, 827].

The author considers that importance attaches to the inoculation soil or humus being in a damp condition; further, the presence of active mycorrhiza free from undesirable fungal contaminants in the inoculum should be verified in the laboratory. A technique should be standardized by which small amounts of potentially active material or sporophores of known or suspected mycorrhiza-formers can be used to 'spawn' heaps or beds of organic material to be utilized later for soil inoculation in nurseries, potting soil, or plantations. Soil inoculation should be resorted to at sowing or planting out, or, in the case of pure culture inocula, after germination, when the plants are still healthy and active. The replies received confirm the view that the same fungus may be associated beneficially with a number of different conifer species, while unable to form mycorrhiza with others. They also confirm the observation that a number of different species of fungi may form balanced associations with any one species of tree. Several such associations may be present at the same time in one tree, especially in the case of pines.

COCKERHAM (G.). **The distribution and significance of certain Potato viruses in Scotland.**—*Scot. J. Agric.*, xxii, 1, pp. 1–11, 1 map, 1939.

The maximum acreage under Majestic, King Edward, and Kerr's Pink potatoes rejected on account of leaf roll in Scotland [*R.A.M.*, xvii, p. 266] (1937 figures) occurs in the south-eastern area. The disease was a common cause of rejection in Arran Consul, Gladstone, and Dunbar Cavalier, while other highly susceptible varieties include Kerr's Pink, Great Scot, Golden Wonder, British Queen, and Up-to-Date. During the year under review, Arran Banner and Doon Star were comparatively free from infection.

Severe mosaic [ibid., xvii, p. 374] is of economic importance only in the south-west, where the locally cultivated potato varieties fall into four groups according to their reactions to viruses A and X, viz., (1) lethally necrotic to both, (2) lethally necrotic to A but not to X, (3) lethally necrotic to X but not to A, and (4) non-lethal to both. Group (1) comprises King Edward, Epicure, and Ninetyfold; (2) Kerr's Pink, Doon Star, Great Scot, Eclipse, Sharpe's Express, Redskin, Duke of York, British Queen, Up-to-Date, Gladstone, and Ballydoon; (3) may be ignored for practical purposes; (4) may be subdivided into (*a*) containing varieties commonly found to be infected by virus A, namely Golden Wonder, Arran Chief, and Catriona, and (*b*) represented by the remaining non-lethally reacting varieties, Majestic, Arran Banner, Arran Pilot, Arran Consul, Ally, May Queen, King George, Dunbar Cavalier, Arran Comrade, Arran Luxury, and Di Vernon. The rejections in groups (1), (2), (4*a*), and (4*b*) on account of severe mosaic amounted to 0·80, 0·64, 12·72, and 1·25 per cent., respectively. The incidence of the disease in the south-west was shown to amount to 7·52, 1·94, 30·74, and 6·94 per cent., respectively, for the four foregoing groups, compared with maxima of 0·50, 1·35, 14·50, and 1·14 per cent., respectively, for other parts of the country. The chief agent of severe mosaic in group (1) is virus Y, which is localized in the south-west; in group (2) it may be due to X, Y, or X+Y; in (4*a*) to A+X or A+X+Y; and in (4*b*) to A+X, A+Y, or X+Y.

The percentages of 'stock seed' (99·95 per cent. pure and containing

no diseases except negligible mottle), grade A (99·5 per cent. pure and not exceeding 1 per cent. mild and severe mosaic, leaf roll, and wildings), and H (not more than 3 per cent. severe mosaic, leaf roll, and wildings) in group (1) were 4·28, 67·96, and 26·18, respectively, the corresponding figures for (2) being 0·27, 12·10, and 72·60, and for (4*b*) 0·28, 6·58, and 85·28, respectively.

**Scottish Society for Research in Plant Breeding. Report by the Director of Research to the Annual General Meeting, 21st July 1938.**—22 pp., 6 figs., 1938.

The following items of phytopathological interest occur in this report. W. Black's studies on the mode of inheritance in potatoes of resistance to blight (*Phytophthora infestans*) [*R.A.M.*, xvii, p. 268 *et passim*] indicated that resistance is dominant to susceptibility. All the $F_1$ seedlings derived from crosses between *S*[*olanum*] *demissum* (resistant) and (1) the Alness and (2) Shamrock (both susceptible) were found to be resistant. An investigation of the botanical characters of resistant seedlings denoted that resistance is either transmitted independently or at any rate not linked with any 'wild' feature undesirable in a commercial variety.

G. Cockerham and C. A. Lyall state that further evidence is forthcoming of the existence of a dominant factor controlling a necrotic reaction in potatoes to virus X which is ultimately lethal to the host [see preceding abstract]. The positive identification of this character should prove of great value in breeding as likely to afford a means of combating the group of disorders caused by the virus and its complexes. Analytical data collected in 1937 demonstrated that the extent of mosaic in Scotland depends primarily on varietal reactions to viruses A and X, and the main object of the potato-breeding programme should therefore be the development of varieties with a necrotic response to these viruses.

Minimum periods of three and four years, respectively, have been found requisite for the assessment of varietal reaction to virus Y and leaf roll [loc. cit.] in field trials.

**Seed testing and plant registration.**—*Scot. J. Agric.*, xxii, 1, pp. 11–17, 1939.

The following items of phytopathological interest occur in this report [cf. *R.A.M.*, xvii, p. 374]. The following reductions in yield of 2 in. ware potatoes from an infected plant may be expected to result from the different viruses recognized in the inspection scheme: negligible mottle [= faint mottling] 20 per cent. in both Majestic and Arran Chief; mild mosaic 40 and 35 per cent., respectively; border-line severe mosaic 56 and 40 per cent., respectively; severe mosaic [see preceding abstracts] 80 and 75 per cent., respectively; and leaf roll [loc. cit.] Golden Wonder 93 per cent. ($1\frac{3}{4}$ in. ware) and Arran Consul 74 per cent. The significance of the top necrosis reaction to viruses A and X, conferring virtual immunity in the field, has now been realized, and seedling 451*a* (20), derived from a cross between Epicure and Pepo and possessing this type of response, has been placed on the register of new varieties after only two years' testing.

Net necrosis [ibid., xvii, p. 701] of Golden Wonder, Arran Consul, Kerr's Pink, and possibly other varieties appears from four years' investigations to be associated with primary leaf roll, of which, however, it is not a constant symptom, having been observed in only 91 out of 724 known cases.

Dry rot of stored potatoes (*Fusarium coeruleum*) [ibid., xvii, p. 374] was found to be negligible in pits left unopened until March, but opening at any time between November and February results in severe infection of the tubers boxed or returned to the pit after dressing. Boxing the tubers at lifting time or later promotes a higher incidence of dry rot than the conditions obtaining in the pit, especially before February. The bagging of tubers taken from the pits in December or January causes more dry rot than any other storage practice. Early varieties show an enhanced degree of susceptibility to *F. coeruleum* following bruising until December, later ones up to February or March. Practically complete control of dry rot may be effected by immersion at lifting in a 1 per cent. solution of an organic mercury compound or formalin for 1 and $\frac{1}{4}$ to $\frac{1}{2}$ minute, respectively; preparations of the former type, remaining on the surface of the tuber as a dust after drying, further assist in checking infection in storage. The small amount of dry rot occasionally developing even in thoroughly treated tubers appears from pot tests to be attributable to soil infection.

Köhler (E.). **Zur Systematik des Kartoffel-X-Virus.** [On the systematic position of the Potato X virus.]—*Naturwissenschaften*, xxvii, 9, p. 149, 1939.

Recent researches necessitate the division of the X virus of potatoes into two groups, one ($X^E$) comprising strains inactivated at 75° C. and the other ($X^N$) represented by those succumbing at 68° (heating the raw juices for ten minutes). Variability is considerable within both groups, which include very weak strains spreading slowly in tobacco, moderately active ones with a normal faculty of permeation, and very powerfully necrotic strains diffusing relatively slowly. The view that both groups belong to the same virus species (X) is upheld by the following criteria. (1) Representatives of one group may be used for protective inoculation against those of the other. (2) Members of both groups agree exactly in respect of sensitivity to heat (24 hours' exposure to a temperature of 50°). Koch's potato mottle virus [*R.A.M.*, xv, p. 459 *et passim*] may constitute a transitional phase between the two categories under discussion.

Köhler (E.). **Beobachtungen über Virusresistenz bei Kartoffelsorten.** [Observations on varietal resistance to viruses in Potatoes.]—*Züchter*, xx, 12, pp. 321–324, 1938.

On the basis of field observations in 1937 at Dahlem, Berlin, the author classified 26 potato varieties into four groups, the first comprising varieties susceptible to both leaf roll and virus Y [*R.A.M.*, xvi, p. 401], the second those susceptible to leaf roll while their reaction to virus Y is not clear, the third those susceptible to virus Y with an uncertain reaction to leaf roll, and the fourth those with reduced susceptibility (either active resistance or tolerance) to both viruses.

A more thorough trial of Altgold, Flava, Jubel, Parnassia (all group IV), Centifolia, Sickingen, Voran (all group I), and Stärkereiche (II) showed that none was resistant to leaf roll, although Altgold, Jubel, Flava, Voran, and Parnassia possessed a high degree of tolerance, being just as receptive to the virus as the strictly susceptible varieties but suffering little or no injury. Altgold and Jubel were highly intolerant and Parnassia moderately tolerant of virus Y. The yields of Altgold, Flava, Jubel, Voran, and Parnassia remained relatively stable for three successive years, whereas those of Centifolia, Sickingen, and Stärkereiche decreased considerably owing to infection. The yield of Voran, which showed severe symptoms of disease, compared surprisingly well with others, indicating a considerable tolerance of both viruses.

It is concluded that by means of transgressive breeding a much higher degree of resistance to, or even immunity from, virus Y could be achieved. It is believed also that a higher degree of tolerance of leaf roll can probably be obtained, and it is suggested that some of the varieties in group II may prove more resistant than the eight tested.

Dennis (R. W. G.). **Studies on Solanum virus 4.**—*Phytopathology*, xxix, 2, pp. 168–177, 1 fig., 1939.

*Solanum* virus 4 (= virus B) from an Up-to-Date potato plant was freed from contamination by *S.* virus 1 (= X) [*R.A.M.*, xv, p. 310] by passage through the X-resistant U.S.D.A. 41956 potato seedling at the Potato Virus Research Station, Cambridge, and its symptoms studied on 18 other hosts, of which *Datura stramonium* and tomato were found to be the most valuable for diagnostic purposes. The former host reacts by a bright systemic mottle with slight necrosis and deformity, and the latter by a characteristic yellow interveinal mosaic. It was found possible to infect King Edward and Arran Crest potatoes with *S.* virus 4 by sap inoculation, the virus being recovered unchanged from the former following infection by this method. In the case of other varieties sap inoculation results in the production of local lesions only.

*S.* virus 4 was inactivated by exposure to a temperature of 70° C., but withstood 65°; it resisted dilution in tobacco sap to 1:100,000 and survived in expressed juice for six weeks.

Mixed infections of *S.* virus 4 with *Nicotiana* virus 1 (= tobacco mosaic) and *S.* virus 2 (= Y), respectively, confirmed the affinity of the first-named with *S.* virus 1. Reinoculation experiments on tobacco, *D. stramonium*, and potato showed that the previous infection of a host with either *S.* virus 1 or *S.* virus 4 does not protect it against subsequent attack by the other.

It is concluded that the strain of *S.* virus 4 under investigation was in a pure state and solely responsible for the manifestations described.

Dennis (R. W. G.). **Notes on the photoperiodic reactions and virus contents of some Peruvian Potatoes.**—*Ann. appl. Biol.*, xxvi, 1, pp. 87–101, 2 pl., 1939.

A consignment of 59 potato varieties collected at Puño by the Percy Sladen Expedition to Lake Titicaca was received in 1937 at the Potato Virus Research Station in Cambridge, and during 1938 their photoperiodic reactions and virus contents were determined in an insect-

proof greenhouse. Among these varieties two forms of Papa surimana, with pink and purple tubers, respectively, appeared to belong to *Solanum chaucha*; Azul parcco, Parcco caramo, Parcco hancco, Luqui mari, and perhaps Pocco tturo huilla appeared to form a homogeneous group so far unidentified, and most of the other varieties are provisionally regarded as forms of *S. andigenum*.

Sap inoculation and graft experiments revealed the absence of viruses in 11 varieties; in the remaining 48 viruses X, B, C, F, G, and possibly leaf roll were detected, and in six varieties viruses or virus complexes were discovered which seemed to correspond to none of the known European viruses. In small-scale infection experiments certain of the Peruvian potatoes were found to contract leaf roll, interveinal mottle (mild X), top necrosis (X+C), and leaf-drop streak [*R.A.M.*, xviii, p. 197], suggesting that great caution should be exercised in introducing South American varieties into England.

Botjes (J. O.). **Een zwakke stam van het virus van de grofmozaïekziekte.** [A weak strain of the mild mosaic disease virus.]—*Tijdschr. PlZiekt.*, xlv, 1, pp. 25–29, 1939. [English summary.]

In addition to the normal dark green-leaved Industrie potatoes under cultivation in Holland, a variant with pale green foliage has developed under the influence of a virus which was shown to be a weak strain of mild mosaic [*R.A.M.*, xviii, p. 337] and is named mild mosaic *b* to distinguish it from the ordinary strain *a*. The former was found to occur in the Juli variety as well as in the pale Industrie, and to be transmissible from both to Eigenheimer and Alpha. Mild mosaic *b* confers a high degree of immunity from mild mosaic proper but not from leaf roll.

Lepik (E.). **Meie Kartulisortide lehemädanikukindlusest.** [Varietal resistance of Potatoes to late blight.]—*Agronoomia*, xviii, 9, pp. 686–692, 741, 4 graphs, 1938. [English summary.]

In 1934 and 1937, when severe epidemics of late blight (*Phytophthora infestans*) occurred in the Estonian potato crop [*R.A.M.*, xvii, p. 482], a high degree of resistance was shown by Hellena, Jõgeva 979, and Alpha and marked susceptibility by Duke of York, Väike verev, Early Rose, Early Puritan, Victoria, Epicure, May Queen, and Charles Downing. Included in the resistant group were Hero, Jubel, Imperator, Industrie, Belladonna, Lorch, Deodara, Pepo, Parnassia, Edeltraut, Kungla, Silesia, and Jõgeva 30; in the medium-resistant Majestic and Centifolia; and in the susceptible Odenwälder Blaue and Royal Kidney.

Lunden (A. P.). **Mål og metoder ved foredlingsarbeidet for sykdomsresistens hos Poteten (Solanum tuberosum).** [Objects and methods in the work of breeding Potatoes (*Solanum tuberosum*) for resistance to disease.]—*Meld. Norg. LandbrHøisk.*, xviii, 3, pp. 183–198, 1938.

In Norway, as elsewhere, late blight (*Phytophthora infestans*) is the most destructive and economically important disease of potatoes [*R.A.M.*, xi, pp. 669, 670]. In the severe epidemic of 1927 the yield amounted to only 605,000 tons compared with averages of 823,000 and 921,000 for the five-year periods 1926 to 1930 and 1931 to 1935,

respectively. It is estimated that in the same year the production of the three most resistant varieties, Marius, Jubel, and Centifolia, was double that of the three most susceptible, Up-to-Date, Great Scot, and Tinwald Perfection. In three years' spraying experiments on a highly susceptible variety there was an average increase of 30 per cent. in the yield of sound tubers and of 40 per cent. in that of dry weight.

Next to late blight, blackleg (*Bacillus carotovorus*) [*Erwinia phytophthora*: ibid., viii, pp. 195, 397] is the most serious disease of the Norwegian potato crop, which on the other hand is stated to sustain relatively little damage from viruses on account of the scarcity of aphids in the cool climate. Wart (*Synchytrium endobioticum*) [ibid., xiv, p. 252] is no longer an economic factor now that immune varieties of superior quality and flavour are available. The various types of scab associated with *Actinomyces* spp. [chiefly *A. scabies*], *Spongospora subterranea*, *Corticum vagum* [*C. solani*], and *Spondylocladium atrovirens* [ibid., xvii, p. 835] are mainly injurious to culinary potatoes. Minor disorders of sporadic occurrence include *Verticillium* and *Fusarium* spp., *Phoma eupyrena* [Wollenweber, *Arb. Forsch Inst. Kartoff., Berl.*, ii, 73, 1920], *Oospora pustulans* [ibid., xiv, p. 466], and *Bacterium sepedonicum*.

Some outstanding researches in connexion with breeding potatoes for resistance to various diseases are summarized.

Leach (J. G.), Decker (P.), & Becker (Hannah). **Pathogenic races of Actinomyces scabies in relation to scab resistance.**—*Phytopathology*, xxix, 2, pp. 204–209, 4 figs., 1939.

In a limited number of greenhouse soil inoculation tests at the Minnesota Agricultural Experiment Station in 1936–7 and 1937–8, potato seedling 5–10–1 proved to be very susceptible to a strain of *Actinomyces scabies* designated race 1 and highly resistant to another strain (race 2), while Jubel was also highly resistant to race 2 but only moderately susceptible to 1. Warba, U.S.D.A. seedling 44537, and Arnica (the two latter tested in 1936–7 only) are highly, moderately, and slightly susceptible, respectively, to both isolates, which were derived from a severe pitted type of infection on the 5–10–1 and Irish Cobbler varieties. These results are considered to afford conclusive proof of the existence of physiologic specialization in *A. scabies*, and furthermore to explain the observed discrepancies in varietal reaction to the disease in different localities. The relatively small number of lesions developing on 5–10–1 is believed to be attributable to the morphological resistance to invasion offered by the small, compact lenticels of this variety [*R.A.M.*, xvi, p. 556], but physiological factors are also thought to be involved in the differential response of various potato types to the disease.

**The occurrence in the United States of the tuber ring rot and wilt of the Potato.**—*Plant Dis. Reptr*, xxii, 22, pp. 444–445, 1938. [Mimeographed.]

Potato tuber ring rot and wilt (*Bacterium sepedonicum*) [*R.A.M.*, xviii, p. 53) is now known to occur in Maine, Florida, Pennsylvania, Wyoming, and Colorado. In a note on p. 446 by G. H. Starr, evidence is briefly presented for the transmission of the disease through seed

planted on virgin soil by the tuber unit method, which gave rise to an average of 10 per cent. infection.

Okada (Y.). **On the distribution of Trichoderma in the soils of various types of vegetation on Mt. Hakkoda.**—*Sci. Rep. Tôhoku Univ.*, Ser. 4, xiii, 3, pp. 271–279, 1938.

A tabulated account is given of the writer's studies on the distribution of *Trichoderma koningi* [*R.A.M.*, xvii, pp. 624, 838] in relation to the various types of plant community on Mount Hakkoda, Japan [cf. ibid., xvii, p. 484]. The presence of the fungus was demonstrated by the method of directly streaking from the freshly exposed soil surface on a plate of Waksman's peptone-glucose acid agar [ibid., ii, p. 233]. *T. koningi* was found to occur in eight of the nine soils of different ecological associations studied, viz., Pseudosasetum ($P_H$ 4·7), Fagetum (3·7), Abietetum (3·7), Pinetum (3·7), detritus surrounding the crater of the volcano (5·4), Cladonietum (2·8 to 3·1), *Sphagnum* moor (3·7), and Narthecietum (3·7), being absent only from bare land near the solfatara (2 to 2·2). The incidence of the mould was high in soils rich in raw humus, and low in waterlogged ground. In the Pseudosasetum soils *T. koningi* was found (mostly in spore form) at a depth of 40 but not at 70 cm.

Kovachevsky [Kovačevski] (I. C.). Нови паразитни гъби за България. V приносъ. [Parasitic fungi new for Bulgaria. Fifth contribution.]—*Rev. Inst. Rech. agron. Bulg.*, viii, 4, pp. 3–13, 1938. [English summary.]

In this contribution [cf. *R.A.M.*, xvi, p. 493] the following species are recorded in Bulgaria for the first time: *Bacterium panici* [ibid., xvii, p. 810] on millet (*Panicum miliaceum*), *Bact. woodsii* on carnation [ibid., xvii, p. 728], *Bact. glycineum* on soy-bean [ibid., xvi, p. 585], *Puccinia antirrhini* on snapdragon (*Antirrhinum majus*) [ibid., xviii, pp. 11, 128], *Didymella lycopersici* on tomato [ibid., xvii, p. 15], *Ascochyta abelmoschi* on okra (*Hibiscus esculentus*) [ibid., vii, p. 297], *Diplodina citrullina* on stems and young fruits of sugar melon, *Septoria acicola* on *Pinus austriaca* [ibid., xvi, p. 218], *S. carthami* on safflower [ibid., xiv, p. 493], *S. pisi* (probably identical with *Rhabdospora hortensis*) on pea [ibid., xviii, p. 237], *Gloeosporium musarum* on banana [ibid., xviii, p. 124], *Ramularia pastinacae* on parsnip [ibid., vii, p. 701], *Cladosporium fulvum* on tomato [ibid., xviii, p. 280], *C. aecidiicola* on spots caused by *Gymnosporangium sabinae* on pear [ibid., xvii, pp. 20, 288], *Cercospora carotae* on carrots [ibid., xvii, p. 17], *C. concors* on potato [ibid., xv, p. 246], and *Fusarium bulbigenum* on *Narcissus* [ibid., xv, p. 224].

A list of new Bulgarian hosts for 12 known parasitic fungi is appended.

Kruszyński (R.). **Krytyczny przegląd chorób roślin zaobserwowanych w północno-wschodniej Polsce w latach 1928–1937 ze szczególnym uwzględnieniem ich znaczenia gospodarczego.** [Critical survey of plant diseases recorded from 1928 to 1937 in north-east Poland, with particular reference to their economic importance.]—*Roczn. Ochr. Rośl.*, v, 6, pp. 68–110, 1938. [German summary.]

This is an annotated list of 257 diseases of economic and ornamental crops, recorded in north-east Poland from 1928 to 1937, inclusive.

Černik (L. F.). **Krankheiten und teratologische Missbildungen (auch typische Verletzungen), an Pflanzen der Olmützer Flora. X Teil.** [Diseases and teratological malformations (also typical injuries) on plants of the Olmütz flora. Part X.]—*Verh. naturf. Ver. Brünn, 1937*, lxix, pp. 91–122, 13 figs., 1938.

This is an annotated list of plant diseases in the Olmütz district of Czechoslovakia [cf. *R.A.M.*, xvii, p. 704].

Bisby (G. R.), Buller (A. H. R.), Dearness (J.), Fraser (W. P.), & Russell (R. C.). **The fungi of Manitoba and Saskatchewan.**—189 pp., 13 pl., 1 map, Nat. Res. Counc. Can., 1938 [issued February, 1939]. $3.50.

This expanded version (to which a preface is contributed by H. T. Güssow) of 'The Fungi of Manitoba' [*R.A.M.*, xi, p. 546] brings the total number of species studied in the two provinces of Manitoba and Saskatchewan to 2,782. The work comprises an introductory analysis of the fungus flora considered under various aspects, taxonomic and geographical notes on most of the species recorded, among which are many parasites of cereals and other cultivated plants, host and fungus indexes, and a nine-page bibliography.

Wehmeyer (L. E.). **Las especies de 'Diaporthe' en el herbario Spegazzini.** [The species of *Diaporthe* in the Spegazzini herbarium.]—*Rev. Mus. La Plata*, N.S., ii, pp. 65–68, 3 pl., 1938.

This annotated list of the species of *Diaporthe* [*R.A.M.*, xiii, p. 270] in Spegazzini's herbarium comprises, *inter alia*, an emendation of Petrak's genus *Cryptodiaporthe* with two new combinations, and a new genus *Melanoporthe* [with a Latin diagnosis], differentiated from the typical representatives of the 'effuse' group by the black coloration of the spores at maturity.

Ray (W. W.). **Contribution to knowledge of the genus Taphrina in North America.**—*Mycologia*, xxxi, 1, pp. 56–75, 23 figs., 1939.

Observations [with Latin diagnoses of new species] are presented on some North American species of *Taphrina* found on *Alnus* and *Prunus* spp., the author following Giesenhagen in including in *Taphrina* all those species formerly included in *Exoascus*, *Taphrina*, and *Magnusiella* [*R.A.M.*, xvii, p. 841]. On *Alnus* are recorded *T. robinsoniana* [ibid., xviii, p. 281], *T. rugosa* n.sp., *T. occidentalis* n.sp. (all on catkins), and *T. media* (on leaves: a new record for North America), and on *Prunus* *T. atkinsonii* n.sp. (fruits and flower parts), *T. farlowii* (fruits), *T. confusa* (flowers), *T. communis* (shoots and fruits), and *T. flavorubra* (shoots and fruits).

The evidence obtained indicated that *T. robinsoniana* causes the catkin disease of *A. incana* and *A. rugosa* in the United States during the summer. Search among different collections failed to show that *T. amentorum* causes any catkin disease of *A. incana* in the United States, though it was observed on the bracts of female catkins of *A. oregona* in a collection made in Alaska in 1899. This fungus was

named *E. amentorum* by Sadebeck in 1888, while in 1890 Magnus named it *T. alni-incanae* [ibid., xv, p. 693], the name now generally used.

Rischkov [Ryjkoff] (V. L.) & Soukhoff (K. S.). **Virus of Tobacco mosaic tested for its power of fermentative activity.**—*C.R. Acad. Sci. U.R.S.S.*, N.S., xxi, 5, pp. 265–268, 1938.

Brief details are given of experiments, the results of which showed that the crystalline protein virus of common tobacco mosaic, prepared by Ryjkoff and Gromyko's method [*R.A.M.*, xvii, p. 708] does not exhibit *in vitro* the properties of an oxidase, peroxidase, catalase, protease, asparaginase, urease, amylase, chlorophyllase, or phosphatase, neither did it show any activating effect on peroxidase. The authors conclude that the increased activity of peroxidase, amylase, and proteases in mosaic-affected plants is due to the effect of the virus on the host rather than to its direct action on these substances. In their opinion the virus, unlike other parasites, does not possess enzyme systems of its own, and is unable to assimilate the proteins of the host.

Bawden (F. C.) & Sheffield (F[rances] M. L.). **The intracellular inclusions of some plant virus diseases.**—*Ann. appl. Biol.*, xxvi, 1, pp. 102–115, 2 pl., 1939.

In this study on the inclusion bodies in virus-infected plant cells [*R.A.M.*, xviii, p. 62] the authors found both amorphous bodies and crystalline plates in cells of plants infected with the common, enation, and aucuba types of tobacco mosaic. The amorphous (or X-) bodies of all three strains are relatively stable, are preserved by ordinary cytological fixatives, and give the usual protein reactions; those of common tobacco mosaic and enation mosaic are small, resemble amoebae, measure about 10 $\mu$ in length, contain vacuoles, chondriosomes, and oil globules, and frequently change their shape, while those of aucuba mosaic are somewhat larger than the other two, more granular, and less like the surrounding cytoplasm. The actual formation of these bodies has been observed in detail only in the case of aucuba mosaic [ibid., ix, p. 538; xiv, p. 51]. After some time the amorphous bodies degenerate and their place is taken by crystalline plates which are formed either separately or in the same cells as the amorphous bodies. They are best seen in living material, since fixation destroys them or causes the formation of numerous striations, an effect responsible for the term 'striate material' for these bodies. They give protein reactions, are very fragile, colourless and transparent, have a refractive index higher than the cell sap, and are true crystals. Under good growing conditions the amorphous bodies are formed about a week after infection, rapidly increasing in number and reaching a maximum about a month after infection; after another month they either disappear, as in tobacco mosaic, or disintegrate and form crystals, as in aucuba mosaic, which disappear in turn after a few months.

It is considered highly improbable that the crystalline inclusions are deposits of pure virus; they are more likely to be insoluble complexes formed by the union of the virus with some constituents of the host. It is shown that the purified virus readily united *in vitro* with some protamines and histones (clupein was specially studied) to form

insoluble complexes, which in many ways resemble the crystalline inclusions. As to the amorphous inclusion bodies, their amorphous nature, greater stability, and different solubility seem to indicate that the virus is combined with a constituent of the host different from that suggested for the crystalline plates, and that the ratio of this constituent to virus is greater than in the crystalline plates. If the inclusions are complexes of the type suggested above, their formation is determined not by the virus concentration [cf. ibid., xvi, p. 570] but by the presence in diseased plants of products not found in healthy cells, capable of uniting with the virus to form the insoluble complexes.

In work with other viruses potato virus Y and cucumber viruses 1, 3, and 4 failed to produce inclusions of any kind; tobacco ring spot virus produced both amorphous and crystalline inclusions in tobacco and other Solanaceous plants, but only few amorphous bodies in cucumber; potato virus X and *Hyoscyamus* virus 3 produced only amorphous bodies; and tomato bushy stunt virus formed no inclusions in the majority of plants, but in a few amorphous bodies were present, and all contained much crystalline material.

Pirie (N. W.), Smith (K. M.), Spooner (E. T. C.), & McClement (W. D.). **Purified preparations of Tobacco necrosis virus (Nicotiana virus II).**—*Parasitology*, xxx, 4, pp. 543–551, 1 pl., 1 graph, 1938.

From the sap expressed from White Burley tobacco leaves artificially infected with tobacco necrosis [*R.A.M.*, xviii, p. 348] (800 to 1,000 plants being necessary to produce 2 l. sap with a virus content of 0·04 per cent.), the authors obtained, by a process involving precipitation with saturated ammonium sulphate solution and repeated centrifuging, one nucleoprotein in a crystalline state with a sedimentation constant of $130\times10^{-13}$ and another in an amorphous state, its principal component having a sedimentation constant of $58\times10^{-13}$. The former separates as thin, lozenge-shaped plates, which are birefringent. Both preparations had substantially the same analytical composition and, like the tomato bushy stunt virus [ibid., xviii, p. 353], show no anisotropy of flow in solution, while the jelly that sediments on centrifugation is also isotropic; the phosphorus and carbohydrate contents were higher than those of the other plant viruses that have been studied. The greater part of a fresh preparation is amorphous, but on ageing gives rise to more crystalline material. Attempts to accelerate the ageing process, however, were unsuccessful and the nature of the difference between the two states remains obscure. Injections of the purified tobacco necrosis virus given intravenously to rabbits resulted in antibody formation, demonstrated by flocculation reactions. Sera which flocculated the purified tobacco necrosis antigens gave no cross-reactions with purified bushy stunt and tobacco mosaic antigens, nor with preparations of healthy sap, indicating that the antigen concerned is intimately associated with the tobacco necrosis virus if it is not the virus itself. Tested on *Phaseolus vulgaris*, which proved to be more sensitive to the virus than tobacco, both preparations were infective at a dilution of 1 in $10^8$, and precipitated specifically with anti-serum at a dilution of 1 in $3{\cdot}2\times10^5$.

Clayton (E. E.), Gaines (J. G.), Smith (T. E.), Lunn (W. M.), & Shaw (K. J). **Control of the blue mold (downy mildew) disease of Tobacco by spraying.**—*Tech. Bull. U.S. Dep. Agric.* 650, 23 pp., 5 figs., 1938.

During the epidemic outbreak of tobacco downy mildew (*Peronospora tabacina*) [*R.A.M.*, xviii, p. 350 and next abstracts] in the United States in 1937, encouraging results in spraying tests in different localities were given by a mixture consisting of red copper oxide ($\frac{1}{2}$ to $\frac{3}{4}$ lb.), lethane spreader (1 qt.), and cottonseed oil ($\frac{1}{2}$ gal.), with water added to make 50 gals. The beds were sprayed twice weekly, five or six applications generally being made before the outbreak became general, and the spraying was continued until the plants were set out or the disease became inactive. The maximum number of applications required was about 15, but that actually given was 23. The treatment generally delayed the appearance of the disease, greatly retarded its development, and considerably reduced its severity. In no sprayed bed did plant mortality from the disease exceed 16 per cent., while in the unsprayed beds it ranged up to 94 per cent. In only two sprayed beds were more than 5 per cent. of the plants killed, while in most of the unsprayed controls 20 to 50 per cent. of the plants were destroyed. In the sprayed beds active disease development in no case persisted for more than four days, after which recovery was prompt and complete, while in the controls infection was active for periods of up to three weeks, and transplanting was delayed for ten days to five weeks. Field stands from the sprayed beds were uniformly good, even if the plants were set out when the disease was most active. On an average, each 100 sq. yds. of sprayed bed gave $2\frac{1}{2}$ to $3\frac{1}{2}$ acres of tobacco, as against 0 to $1\frac{1}{3}$ acres from the same area of unsprayed. Colloidal copper, copper-soap, and calcium monosulphide were all superior to Bordeaux mixture but none was effective enough to be recommended.

Pinckard (J. A.), Wolf (F. A.), McLean (Ruth), Darkis (F. R.), & Gross (P. M.). **Laboratory studies on toxicity of benzol vapors to Tobacco seedlings and to Peronospora tabacina.**—*Phytopathology*, xxix, 2, pp. 177–187, 2 figs., 1 diag., 1939.

An account is given of laboratory experiments to determine the minimal concentrations of benzol vapour in air toxic, respectively, to tobacco seedlings and *Peronospora tabacina*, the agent of downy mildew [see preceding and next abstracts]. The tests were carried out in (*a*) bell jars sealed with various materials, of which shellac was the best, and (*b*) a specially devised apparatus consisting of open chambers fitted with a circulation pump for the continuous renewal of the benzol-air mixture. The volume-percentage concentrations of benzol in the benzol-air mixtures were analysed by the combustion method and found to agree very closely with the calculated values.

At atmospheric pressure, concentrations of benzol vapour in air exceeding about 2 per cent. by volume were injurious to the seedlings if the foliage was wet during the treatment, the corresponding strength for dry leaves being 3 per cent. The sporangia of the fungus were destroyed by concentrations of benzol vapour in air of 0·5 per cent.

and upwards, but the repeated exposure of infected seedlings to less than 0·5 per cent. of benzol by volume inhibited sporulation. At pressures less than atmospheric, injury was caused by lower concentrations of the vapour.

The mechanism of the toxic action of benzol towards plants would appear from these studies to involve, in the first place, absorption by the cell walls, and secondly, the dissolution of the lipoidal substances in the plasma membrane, leading to adverse modifications of permeability and allied functions.

Wolf (F. A.), Pinckard (J. A.), Darkis (F. R.), McLean (Ruth), & Gross (P. M.). **Field studies on concentration of benzol vapours as used to control downy mildew of Tobacco.**—*Phytopathology*, xxix, 2, pp. 103–120, 2 figs., 1 diag., 4 graphs, 1939.

Previous field and laboratory experiments demonstrating the efficacy of benzol vapours in the control of tobacco downy mildew [*Peronospora tabacina*: see preceding and next abstracts] were confirmed by the present series of seed-bed trials on some 25 standard flue-cured varieties, Turkish, Burley, and hybrids in North Carolina and Virginia.

The use of a Mine Safety Appliance combustible gas indicator [ibid., xviii, p. 63] facilitated the computation of measurements of the benzol vapour concentration. The limits of toxicity of the fumigant to the pathogen (0·40 to 0·50 per cent. by volume) and to the host (2 to 2·5 per cent.) are so widely separated that the risk of injury to the seedlings, even from a heavy excess dose, is regarded as negligible. Factors influencing the efficiency of benzol fumigation, as measured by vapour concentrations, include the amount applied per unit area of seed-bed; ratio between area of evaporators and that of seed-bed; porosity and penetrability of the covers conditioned by their texture and by the amount of rain or dew collecting on them; modifications in the volatilization rate induced by temperature and the mixture of lubricating oil with the benzol; and the presence of water on the foliage of the seedlings. Of these, the most important is the presence of moisture on the covers and on the plants, bearing out laboratory observations on the mechanism of the action of benzol vapour through the vehicle of water [loc. cit.]. The effective concentrations of the vapour in the free water on the foliage and in the cell constituents have not yet been exactly defined, but are assumed from the available evidence to be in excess of those in the atmosphere of the beds.

Wolf (F. A.). **Status of investigations of Tobacco downy mildew.**—*Phytopathology*, xxix, 2, pp. 194–200, 1939.

Summing up the present position as regards the knowledge of the endemism of tobacco downy mildew (*Peronospora tabacina*) [see preceding and next abstracts] in the United States, the sources of inoculum, dissemination of sporangia, and climatic factors in relation to the disease, the writer draws attention to the lack of information concerning the vital phenomena of oospore production and the potential acquisition of immunity by seedlings recovering from an attack. Various fundamental problems connected with the control of the mildew by benzol also remain to be solved.

Pinckard (J. A.) & McLean (Ruth). **Paradichlorbenzol, an eradicant fungicide, effective against downy mildew of Tobacco.**—*Phytopathology*, xxix, 2, pp. 216–219, 3 figs., 1939.

In tobacco seed-bed experiments during the downy mildew [*Peronospora tabacina*: see preceding abstracts] epidemic of 1938 in North and South Carolina and Virginia, repeated nightly applications at a maximum temperature below 75°F. of 28 gm. crystalline paradichlorbenzol were found to be fungistatically equivalent to 25 ml. liquid benzol in seed-beds 4 sq. yds in area, covered with cotton sheeting of a warp and woof of 64 threads per in. and a weight of 1 lb. per 2·68 sq. yd. It was essential, however, to place the crystals above the plants on netting evaporators protected against the weather; muslin sheeting, as ordinarily used on seed-beds, proved ineffectual in the retention of the heavy vapours preventing infection. Eradicant fungicidal vapour concentrations were obtained in seed-beds 4 sq. yds in area by one 12-hour treatment with 112 gm. crystalline paradichlorbenzol spread over net evaporators 18 in. square. An increase in the concentration of the fumigant by the use of 225 gm. resulted in an approach to phytocidal strength, while a 453 gm. dose was definitely injurious to the plants.

Thung (T. H.). **De epidemiologie van de Phytophthora parasitica var. nicotianae op de Vorstenlandsche Tabaksondernemingen.** [The epidemiology of *Phytophthora parasitica* var. *nicotianae* on the Vorstenland Tobacco plantations.]—*Meded. Proefst. vorstenl. Tab.*, 86, 55 pp., 1 fig., 1 diag., 1 graph, 1938. [English summary.]

In laboratory inoculation tests at the Vorstenland (Java) Tobacco Experiment Station, *Phytophthora parasitica* var. *nicotianae* [*R.A.M.*, xvii, p. 490] was found to be capable of attacking, besides tobacco, wounded leaves of cassava, *Eriodendron anfractuosum*, papaw, *Jatropha curcas*, *Ricinus communis*, and eggplant, corresponding uninjured material being infected only in the cases of *J. curcas* (1 out of 5) and *R. communis* (5 out of 5). The fungus was further shown to thrive in samples of the silt, sand, clay, and loam soils constituting singly or in combination the tobacco-growing land of the district.

The zoospores of *P. parasitica* var. *nicotianae* are frequently liberated immediately the sporangia come into contact with water, but in some of the writer's tests a fall of temperature from the initial 27° to 28·5° C. was requisite to induce the process (e.g., five minutes at 16° or 19° or ten at 17·5°). The zoospores were unable to infect the upper side of tobacco leaves in inoculation experiments and attacked the under side only with difficulty, but readily formed new mycelium in the above-mentioned soils and on oatmeal or plum agar. The fungus was killed by one hour's exposure to a temperature of 50° and by two hours at one of 49°, as well as by desiccation (one month over lime in culture tubes, nine in soil in the laboratory). Soil temperature data indicated that, in general, the hot, dry tobacco-growing areas of the Vorstenland are free from infection before planting, exceptions being sites surrounding barns, old rice seedling beds, and water inlets, where diseased plants constituted an average of 21·6 per cent. of the total in 1936. In constantly shaded moist soils *P. parasitica* var. *nicotianae* may persist

throughout the year; in the water of rice fields and streams the temperature mostly permits survival, but the fungus is liable to bacterial and protozoan attacks. Rain brings about a fall in soil temperature that assists the liberation of the zoospores, which are transported by water and convey infection to new areas, especially in low-lying situations. Four years' observations on the incidence of soil and water infections on a heavily infested site denoted that an epidemic increase of inoculum takes place solely on the tobacco plants, the first diseased individuals serving to spread contagion over the entire plantation and its surroundings unless instantly checked. Manure introduced into the plantations from villages still appears to be a prolific source of contamination. The infestation of stream and irrigation channel water is a factor of importance only when the tobacco crop is actually under cultivation.

Particulars are given of a new method for the detection of *P. parasitica* var. *nicotianae* in soil and manure, applied as follows. Water flowing at a velocity of 20 l. in 15 minutes carries infection from a suspension of soil or manure over a series of three tins, each containing 16 tobacco leaves, for two hours, after which the leaves are transferred to other tins and kept moist for three days; at the end of this period the incidence of infection may be gauged by the number of spots formed.

Paul (W. R. C.) & Fernando (M.). **Some studies on Tobacco diseases in Ceylon. V. The use of fungicides in the control of damping-off of Tobacco seedlings.**—*Trop. Agriculturist*, xci, 6, pp. 338–344, 2 pl., 1 graph, 1938.

The authors present some data collected during an experiment in 1938 at the Ganewatta Experiment Station, showing that damping-off (*Pythium* spp.) of tobacco seedlings in the seed-bed was almost completely controlled by weekly spraying with a proprietary colloidal copper compound (1 oz. per gal. plus $\frac{1}{16}$ oz. proprietary spreader), whereas a proprietary product containing 25 per cent. salicylanilide and a proprietary copper-lime dust gave no significant control. The total cost of treatment with the first-named fungicide was estimated to be under 20 cents for an area of seed-bed sufficient for planting one acre in the field.

Milbrath (J. A.). **Tomato tip-blight virus.**—*Phytopathology*, xxix, 2, pp. 156–168, 4 figs., 1939.

In further studies on the tomato tip blight virus at the Oregon Agricultural Experiment Station [*R.A.M.*, xviii, p. 350], the writer found that undiluted juice loses its infectivity within an hour at 65° F. or above. The thermal death point is very low, lying between 40° and 41·5° C., or close to 36° for juice heated in 250 c.c. flasks. Inoculation experiments on Connecticut Havana tobacco leaves showed that dilution with water causes a rapid loss of virulence, the average number of local lesions per leaf being reduced from 17·2 for undiluted juice to 12·4, 5·6, and 0 for dilutions of 1 to 1, 1 to 20, and 1 to 50, respectively.

Tomato, *Datura stramonium*, *Solanum capsicastrum*, Bliss Triumph potato, nasturtium (*Tropaeolum*) [*majus*], and tobacco were found to be the most suitable hosts for the symptomatological differentiation of the virus. The outstanding features of infection, either natural (by

*Thrips tabaci*) or artificial, on tomato are stem-streaking and circular, necrotic, foliar lesions. Local necrotic lesions may or may not develop on *D. stramonium* leaves; if present they are few, of irregular outline, and black. The secondary lesions formed on the younger foliage are at first faintly chlorotic, circular, with a small, necrotic centre which eventually spreads until the whole spot becomes a black lesion coalescing with the adjoining ones. Finally, severance takes place at the abscission layer and the leaf falls from the plant. On *S. capsicastrum* the only symptoms are large, black, necrotic local lesions with a faint chlorotic edge, usually only one or two per leaf. The black, necrotic lesions formed five to six days after inoculation on potato leaves attain a diameter of nearly ½ in. and assume a concentric configuration due to the presence of slightly raised, dark, narrow ridges. The remaining area soon becomes chlorotic and the leaf falls from the plant. Infected nasturtium leaves turn yellow or orange, and eventually wither and die. The secondary symptoms are a striking patchy or diffuse mottling or the formation of circular, black spots with pale green margins. Although the affected leaves soon wither and drop, the meristematic regions are not destroyed and new foliage continues to develop. Black, necrotic local lesions are produced on tobacco leaves four or five days after inoculation, and are occasionally followed by secondary necrotic spotting.

Attention is drawn to some important differences between the tomato tip blight virus and the following tomato diseases with which it might be confused: *Datura* virus 1 [bushy stunt: ibid., xviii, pp. 210, 353], ring spot type of tomato virus [ibid., xvi, p. 501], die-back streak [ibid., xiv, p. 201], and spotted wilt [ibid., xviii, p. 65]. Die-back streak is thought to be possibly due to a mixture of the spotted wilt and tip blight viruses.

Harrison (A. L.), Young (P. A.), & Altstatt (G. E.). **Control of Tomato diseases in the seed bed and cold frame.**—*Circ. Tex. agric. Exp. Sta.* 82, 14 pp., 4 figs., 1939.

Directions are given in popular terms for the control of the following diseases affecting tomatoes in the seed-bed and cold frame in Texas: pre- and post-emergence damping-off (*Pythium*, *Phytophthora*, and *Rhizoctonia* spp.), collar rot (*Rhizoctonia* and *Alternaria* [*solani*: *R.A.M.* xviii, p. 66]), mosaic, bacterial spot [*Bacterium vesicatorium*: ibid., xvi, p. 419], bacterial canker [*Aplanobacter michiganense*], stem canker (*Alternaria solani*), leaf spot [*Septoria lycopersici*], and early blight [*A. solani*]. Seed treatment with cuprocide, metrox (purple copper oxide) [ibid., xvi, p. 625] (both at ⅖ oz. per lb.), 2 per cent. ceresan (⅕ oz.), or semesan ( 1/11 oz.) is recommended against pre-emergence damping-off, while the later phase of the same trouble may be arrested by drenching the surface of the soil with semesan 1 in 400, 1½ qts. per 10 sq. ft., cuprocide or cuprocide-54 [ibid., xvii, p. 722] (1 and 1¾ lb. in 50 gals. water, respectively). Collar rot may be combated by thorough applications of Bordeaux mixture 3–3–50 or cuprocide-54 (1¾–50), the former at 10- to 14-day intervals also being effective against leaf spot and blight.

Artemieva (Mme Z. S.). Исследования штаммов возбудителя бактериального рака Томатов. [A study of the strains of the causal organism of Tomato bacterial canker.]—*Pl. Prot., Leningr., 1938*, 17, pp. 137–140, 1938.

The author states that while so far *Aplanobacter michiganense* has not been recorded officially on tomatoes in the U.S.S.R. [*R.A.M.*, xv, p. 399], isolations from dried specimens of tomato plant parts and fruits received from the Crimea and North Caucasus yielded numerous strains of bacteria, certain of which closely resembled in their morphological, cultural, and biochemical properties the description of *A. michiganense*.

Park (M.) & Fernando (M.). **The relative resistance of some Tomato varieties to bacterial wilt (Bacterium solanacearum E.F.S.).**—*Trop. Agriculturist*, xci, 6, pp. 333–337, 1 diag., 1938.

The results of preliminary experiments in 1938 at Peradeniya, Ceylon, on soil heavily and comparatively uniformly infected with *Bacterium solanacearum* [*R.A.M.*, xvii, p. 631], showed that the eight tomato varieties tested ranged themselves in the following order of wilt resistance: Marvana, Red Marhio 2, Marglobe, Pritchard, Red Marhio 1, Break O'Day 1 and 2, and a local unnamed variety, the first three being significantly more resistant than the other varieties though no statistically significant difference was observed between the first three or the last five. The mortality, even in Marvana, was just under 50 per cent. and the infection in the remaining five varieties was in the neighbourhood of 66 per cent.

Strong (M. C.). **A new Fusarium-wilt-resistant Tomato.**—*Quart. Bull. Mich. agric. Exp. Sta.*, xxi, 3, pp. 164–169, 2 figs., 1 graph, 1939.

A strain of the John Baer tomato variety resistant to *Fusarium* [*bulbigenum* var.] *lycopersici* [*R.A.M.*, xvii, p. 419] has been developed at the Michigan State College. During a period of four years it has shown only from 7 to 19 per cent. infection in soils heavily infected with many different isolates of the fungus from a large number of localities.

Murrill (W. A.). **New Florida Polypores.**—*Bull. Torrey bot. Cl.*, lxv, 9, pp. 647–661, 5 figs., 1938.

An annotated list is given of 28 Polyporaceae, including 21 new species [with Latin diagnoses] and one new combination, collected in central Florida, mostly on decayed hardwood logs.

Jenkins (A[nna] E.) & Siegler (E. A.). **Distribution of popcorn disease of Mulberry.**—*Plant Dis. Reptr*, xxii, 21, pp. 435–438, 1 map, 1938. [Mimeographed.]

Since the distribution of the 'popcorn' disease of mulberry (*Sclerotinia carunculoides*) was defined in 1923 [*R.A.M.*, iii, p. 48], three new States have been added to the range of the fungus [data on which are tabulated], namely, Florida, Louisiana, and North Carolina. The disease was originally reported only on the introduced white mulberry (*Morus alba*), but a few records of its occurrence on the native red species (*M. rubra*) have since been received. Infected fruit is useless as fodder for hogs.

Pirone (P. P.). **The detrimental effect of Walnut to Rhododendrons and other ornamentals.**—*Plant Dis. Reptr*, xxii, 22, pp. 450–452, 1938. [Mimeographed.]

Attention is drawn to the toxic effects of black walnut (*Juglans nigra*) roots to *Rhododendron catawbiense* and other ornamentals in a New Jersey nursery. The nine-year-old rhododendrons were transplanted in the spring of 1938 to a cleared area on the slope of a hill, with five walnuts, 12 to 18 in. in diameter, left near the edge. Early in July the plants in a circular area below the largest tree suddenly wilted and died, and subsequently the bulk of the plot became similarly affected. The injury occurred mostly along the direction of the main walnut roots, spreading in fan-like areas away from the trunk. All attempts at the isolation of a pathogen from the diseased tissues gave negative results, and the removal of most of the walnut roots from the beds led to the rapid disappearance of the trouble. Evidently the roots secrete a substance (possibly juglone, according to A. B. Massey in *Phytopathology*, xv, pp. 773–784, 1925), which is antagonistic to other plants in the immediate vicinity but does not survive the eradication of the trees.

Miller (P. W.). **A promising new copper spray for the control of Walnut blight.**—*Proc. Ore. St. hort. Soc.* (*1938*), xxx, pp. 148–151, 1939.

The author states that in 1935 two applications of copper oxalate spray (1–50) applied to walnut trees in Oregon in the late pre- and early post-bloom stages reduced the incidence of blight (*Phytomonas* [*Bacterium*] *juglandis*) [*R.A.M.*, xvii, p. 420] from 58·6 (in the unsprayed controls) to 4·3 per cent., the corresponding figures for two applications of Bordeaux mixture (2–2–50) being 58·6 and 7·6 per cent. The treatment caused no perceptible foliage injury. In 1937, when infection was very severe, three applications of copper oxalate (2–50) made in the early pre-, late pre-, and early post-bloom stages reduced infection from 82·4 to 5·5 per cent., whilst similar applications of Bordeaux mixture (2–1–50) reduced it to 15 per cent. Used at half-strength, the copper oxalate was about equal to the Bordeaux mixture. In 1938, in the few districts where the disease was prevalent, copper oxalate again gave excellent control without foliage injury, two applications ($1\frac{1}{2}$–50) in one orchard at early pre- and early post-bloom reducing infection from 30·4 to 2·1 per cent. In another locality three applications of copper oxalate ($1\frac{1}{2}$–50) made in the early pre-, late pre-, and early post-bloom stages reduced infection from 36·2 to 7·3 per cent., treatments with Bordeaux mixture (2–1–50) permitting 13·7 per cent. infection.

In 1937, a plot of ten representative trees sprayed three times with copper oxalate (2–50) averaged 40·3 lb. of cured nuts per tree as against 24·7 lb. for trees of corresponding size in an adjoining plot given three applications of Bordeaux mixture (2–1–50), and 17·1 lb. for the unsprayed controls. In a further test, using copper oxalate (2–50) and Bordeaux mixture (2–2–50), the corresponding figures were 56·8, 53·9, and 46·9 lb.

It is tentatively concluded that under Oregon conditions, copper oxalate (1½ to 2 lb. per 50 gals.) gives better control of walnut blight than Bordeaux mixture (2–2–50), and that without injury to the foliage. Small-scale tests with this material by interested growers would appear to be warranted.

Miller (P. W.). **Studies on Filbert blight and its control : second report of progress.**—*Proc. Ore. St. hort. Soc.* (*1938*), xxx, pp. 166–171, 1939.

Owing largely to exceptionally rainy weather during the autumn and winter of 1937–8, filbert trees [*Corylus avellana*] in western Oregon were widely affected during the latter year by blight, due to a species of *Bacterium* [closely resembling *Bact. juglandis*: *R.A.M.*, xvii, p. 420], which caused losses of 5 to 35 per cent. of the trees in orchards up to three years of age, and an estimated crop loss in older orchards of 10 to 25 per cent. The attack reached its peak towards the end of April, and by early summer it was practically over.

Three applications of Bordeaux mixture (4–2–50), made in late summer (before the first autumn rains), in late autumn (when about half the leaves were off the trees), and in early spring (when the leaf buds were opening and the green tips of the leaves were showing) reduced bud and twig blight in bearing orchards to negligible proportions. The same programme is recommended when the critical period for infection (autumn and early winter) is very wet; in other years, one application in later summer or early autumn, before the first autumn rains, appears to suffice.

Darbellay (J.). **Constatations et réflexions sur le Pin Weymouth.** [Authenticated facts and reflections concerning the Weymouth Pine.]—*J. for. suisse*, xc, 2, pp. 25–29, 1 fig., 1939.

In connexion with an account of the white pine [*Pinus strobus*] stands of Vaud, particularly that of the Chanéaz, covering an area of 109 hect., the writer mentions a notable regression in the incidence of blister rust (*Peridermium strobi*) [*Cronartium ribicola*] since 1934, when the young polewood plantings were subjected to intensive clearing and all diseased individuals uprooted. These plantings had contracted infection from neighbouring currants, whereas the 50-year-old stands were comparatively resistant. To-day, thanks to energetic control measures, the equilibrium between the young and old populations is largely restored.

Carter (J. C.). **Coleosporium vernoniae on Pinus rigida in Illinois.**—*Plant Dis. Reptr*, xxii, 21, p. 433, 1938. [Mimeographed.]

Severe infection of nursery plants of *Pinus rigida* by the aecidial stage of *Coleosporium vernoniae* was observed in Union County, Illinois, in May, 1938. The rust occurred in a virulent form on a timber-covered hill a few hundred yards from the nursery and less destructively in the latter itself. Hosts of *C. vernoniae* previously reported from the State include *Vernonia baldwini*, *V. missurica*, *V. noveboracensis*, and *V. fasciculata*.

Liese (J.). **Zur Frage des weiteren Anbaues der Douglasie in Deutschland unter Berücksichtigung der Adelopus-Nadelschütte.** [A contribution to the question of the further cultivation of the Douglas Fir in Germany in relation to the *Adelopus* needle-fall.]—*Mitt. dtsch. dendrol. Ges.*, li, pp. 212–218, 2 pl., 1 fig., 1938.

Summing up the available knowledge concerning the needle-fall (*Phaeocryptopus gaeumanni*) of the Douglas fir [*Pseudotsuga taxifolia*: *R.A.M.*, xviii, p. 75], the writer concludes that the further cultivation in Germany of this very valuable tree should be possible with strict attention to the selection of resistant types. A recent communication from Prof. Malcolm Wilson reports the presence of the fungus in British Columbia, Oregon, and Washington, where it causes abundant infection of Douglas fir along the coasts, though with little or no damage. Needle-fall was observed by the author and Frl. v. Gaisberg on a visit to Scotland, and severely infected material has also been received from Eire.

Macdonald (J. A.). **Coniophora puteana (Schum.) Karst. on living Sequoia gigantea.**—*Ann. appl. Biol.*, xxvi, 1, pp. 83–86, 1 pl., 1939.

A fungus isolated from a 36-year-old tree of *Sequoia gigantea* felled in a garden at St. Andrews, Scotland, in 1936, was identified as *Coniophora puteana*. On malt, prune, and potato dextrose agars, the organism [*R.A.M.*, xvii, p. 282] grew at first white, silky, with prominent strands, becoming denser, woolly, with tangled, loose hyphae above the mat, the colour rapidly becoming tinged with yellow and finally patched with brown; the hyphae bore single, paired, and verticillate clamp-connexions; oidia were freely produced and appeared to be present in all cultures more than a fortnight old. The growth rate of colonies in tube culture, calculated over a period of 12 days, showed an average increase of 2·3 cm. in two days. Characteristic mycelial strands were prominent in the earlier stages of growth, and the thicker of them bore irregularly shaped, dark brown, sclerotioid structures, up to 2 mm. in diameter. Brown zone lines were also formed. The rot produced by the fungus in culture and in nature was characterized by horizontal cracks in the wood. The loss in weight of artificially infected blocks of *S. gigantea* due to the activity of the fungus amounted to approximately 17 per cent. This is believed to be the first record of a *Coniophora* on *S. gigantea*, and as the fungus was the only organism present it clearly acted as a primary parasite.

Thomas (A. V.). **The prevention of 'blue stain' in Jelutong timber.**—*Malay. Forester*, viii, 1, pp. 18–21, 1939.

Planks of *Dyera costulata*, 3 in. thick, treated in different ways with various chemicals and then stacked for six months in the air, were found to dry satisfactorily without developing a serious amount of blue stain, believed to be due to *Diplodia* [*R.A.M.*, xv, p. 133]. Slightly better results were obtained generally with logs sawn up soon after arrival than with those sawn after 14 to 15 days in the open, and lignasan (0·2 per cent.) [ibid., xviii, p. 364] and sodium silicofluoride (1 per cent.) were slightly more effective than borax (5 per cent.). The last-named

was also found to be unsuitable for the treatment of piling stickers, whereas those treated with lignasan showed very little stain.

Rabanus (A.). **Über die Säure-Produktion von Pilzen und deren Einfluss auf die Wirkung von Holzschutzmitteln.** [On the acid production of fungi and its influence on the action of wood preservatives.]—*Mitt. dtsch. Forstver.* 23, pp. 77–89, 4 figs., 9 graphs, 1939.

Particulars are given of laboratory experiments demonstrating the production by *Polyporus vaporarius* [*Poria vaporaria*], *Polyporus sulphureus*, *Merulius domesticus* [*M. lacrymans*], *Fomes igniarius*, *F. annosus*, *Coniophora cerebella* [*C. puteana*], *Polystictus versicolor*, *Lenzites abietina*, and certain other wood-destroying fungi on 2·5 per cent. malt extract solution of sufficient quantities of oxalic acid to convert the copper carbonate formed from copper sulphate on treated telegraph poles into an insoluble copper oxalate innocuous to these organisms. The alleged inadequacy of the copper sulphate treatment of structural timbers on calcareous soils in Germany and Switzerland is attributed, not to any deleterious influence of lime *per se*, but solely to this faculty of certain lignicolous fungi for the production of oxalic acid.

Kallenbach (F.). **Bemerkenswerte Hausschwammschäden.** [Noteworthy dry rot damage.]—*Z. Pilzk.*, N.S., xvii, 3–4, pp. 87–90, 2 pl., 1938.

*Paxillus acheruntius* [*P. panuoides*: *R.A.M.*, xvii, p. 641] is recorded as having caused considerable damage in a new house in Germany for which insufficiently dried timber had been used. It is suspected that the infection was introduced into the building on planks from which the bark had not been removed.

Richardson (N. A.) & Larner (E. E.). **Leaching tests on aqueous wood preservative mixtures containing alkali chromates.**—*J. Soc. chem. Ind., Lond.*, lviii, 2, pp. 66–69, 1 diag., 1939.

Details are given of the methods and results of leaching tests on Scots pine [*Pinus sylvestris*] wood blocks at the Forest Products Research Laboratory, Princes Risborough, Bucks., of the water-soluble wood preservatives, mercuric chloride, zinc chloride, copper sulphate, sodium arsenate, and sodium fluoride, each combined with potassium dichromate in appropriate proportions. The apparatus used was a modified form of Soxhlet extractor. The impregnation treatment consisted of a vacuum of 25 in. followed by a pressure of 90 lb. per sq. in., each for one hour.

The experimental data indicated that with certain salts, notably mercuric chloride, a substantial degree of fixation in wood (over 95 per cent.) can be obtained by the admixture of potassium dichromate. The extent of fixation was not appreciably reduced by the addition to the mixture of sodium nitrite to prevent the corrosion of metal. It is not possible at this stage, however, to deduce the chemical changes taking place as a result of contact between the treating solutions and the wood. They are certainly very complex and no doubt vary in the different mixtures. All the blocks treated with a solution containing potassium dichromate, either alone or in admixture with other salts, turned

brownish immediately after impregnation. On drying, however, the wood in some cases gradually assumed a greenish hue, suggesting the reduction of the potassium dichromate to a chromium salt. With solutions of a neutral or alkaline reaction, e.g., mercuric chloride with potassium chromate and sodium nitrate, the treated wood maintained a uniform yellowish-brown tint.

Tompkins (C. M.) & Ark (P. A.). **Club root of crucifers in California.**—*Plant Dis. Reptr*, xxiii, 1, p. 4, 1939. [Mimeographed.]

The first record of club root of crucifers (*Plasmodiophora brassicae*) in California appears to date from 1905, when the disease was reported on turnip [*R.A.M.*, xv, p. 547]. In 1938 it was present on semi-mature cauliflower-broccoli (*Brassica oleracea* var. *botrytis*) of the purple-heading type on a San Francisco farm, where infection is said to have commenced in 1931 on a small area of less than $\frac{1}{4}$ acre and since spread over six acres, affecting various crucifers.

Tompkins (C. M.). **A mosaic disease of Radish in California.**—*J. agric. Res.*, lviii, 2, pp. 119–130, 5 figs., 1939.

Since 1933, radishes in market gardens near San Pablo, California, have been affected by a mosaic disease characterized both under field and greenhouse conditions by small, roughly circular to irregular, chlorotic lesions between or adjacent to the veins, and later developing into a coarse mottle. After 10 to 14 days the normal leaf tissue appeared as irregular, non-raised islands on a conspicuous, yellowish-green chlorotic background. Little or no leaf distortion was present, though occasionally raised, dark green islands occurred on artificially inoculated plants in the greenhouse. Wild or escaped radish was ascertained to be highly susceptible, and is probably an important source of infection.

The virus was readily transmitted by rubbing, but attempted transmission by three aphids was uniformly unsuccessful. The incubation period ranged from 9 to 18 days. No variety of radish tested was resistant. The virus was transmitted to 19 species of plants belonging to 9 genera in 4 families, and was recovered from all except spinach. It was lethal to Virginian stock (*Malcomia maritima*) and evening scented stock (*Matthiola bicornis*), and occasionally to spinach, produced local chlorotic lesions on the leaves of *Nicotiana glutinosa* and tobacco, systemic chlorotic rings on *N. rustica* var. *humilis*, and systemic chlorotic and necrotic lesions on *N. langsdorffii*. Other susceptible hosts included *Brassica pe-tsai*, kale, Brussels sprouts, cabbage, sprouting broccoli, cauliflower, kohlrabi, black and white mustard (*B. nigra* and *B. alba*, respectively), turnip, Chinese mustard (*B. juncea*), Chinese radish (*Raphanus sativus* var. *longipinnatus*), several cruciferous weeds, and *Delphinium ajacis*. Annual stock (*M. incana* var. *annua*) was resistant.

The virus retained its infectivity after ageing for 14 days at 22° C., was inactivated by heating for 10 minutes at 68°, and caused infection in dilutions up to 1 in 14,000. It can readily be differentiated from other crucifer viruses by the symptoms it induces, its experimental host range, and its properties.

Brandenburg (E.). **Über die Grundlagen der Boranwendung in der Landwirtschaft.** [On the principles of boron application in agriculture.]—*Phytopath. Z.*, xii, 1, pp. 1–112, 20 figs., 6 graphs, 1938.

In this monographic study on the effect of boron on plant growth, the author points out that in experiments with beet the lack of boron led to a decline in the weight increment of the plant before any outward signs of infection appeared; later growth was arrested, and eventually the plant died off, though recovery took place when boron was introduced in time. Most of the boron taken up by the beet plant is deposited in the leaves, so that the older foliage of a plant may contain normal amounts of boron, while the younger, grown in a period of a subsequent boron scarcity, may contain small amounts only.

The results of sand culture experiments showed that the boron requirements of beets depend on the amount of other elements present, being higher the better the supply of other elements.

Analytical investigations again confirmed earlier conclusions that boron deficiency is responsible for heart and dry rot of beets. Leaves of such beets have a lower boron content than those of healthy beets from the same field, the difference being less noticeable in the root. Periods of summer drought and alkaline reaction of the soil, which were previously considered direct causes of heart and dry rot, are instrumental in diminishing the absorption of boron on poor soils. The addition of 20 or 30 kg. of borax per hect. controlled heart and dry rot, had a most favourable effect on the sugar content, and increased the yield by 30 or more per cent. From an analysis of healthy and diseased beet leaves it is concluded that the lower limit of boron deficiency lies at 100 mg. boric acid per kg. of dry substance, while it appeared from field experiments that 170 to 400 mg. per kg. of dry substance constitutes a normal and sufficient boron content. An analysis of the field experiments showed that the addition of 20 to 30 kg. borax per hect. to soil completely lacking in boron was just sufficient to give a normal boron content to the leaves. The addition of these amounts of boron to the soil does not usually raise the boron content of the plant immediately, and under adverse weather conditions it may take many years to reach that of normal plants. The amounts of boron contained in Chile saltpetre reduced the incidence of heart and dry rot in the field but did not suffice to control the disease in poor soils. Since the symptoms of boron deficiency appear in very young beet plants, the boron should be applied either shortly before or directly after planting. The varieties of fodder beet tested varied in their susceptibility to heart and dry rot.

The glassiness of fodder beets often occurring in North Germany is also considered to be a boron deficiency disease, being controllable by the application of 30 to 40 kg. of borax per hect. Species of *Brassica* are more sensitive to boron deficiency than species of *Beta* and show symptoms of infection much earlier.

Walker (J. C.). **Internal black spot of Garden Beet.**—*Phytopathology*, xxix, 2, pp. 120–128, 4 figs., 1939.

Particulars are given of the writer's studies on internal black spot of canning beets in Wisconsin, and of preliminary experiments in its

control by means of soil treatments with borax, a note on which has already appeared from another source [*R.A.M.*, xviii, p. 366].

ROLAND (G.). **Onderzoekingen verricht in 1937 over de vergelingsziekte en enkele minerale gebreken bij de Biet en de Spinazie.** [Investigations carried out in 1937 on yellows disease and some mineral deficiencies in Beet and Spinach.]—*Tijdschr. PlZiekt.*, xlv, 1, pp. 1–22, 1 pl., 1939. [French summary.]

Continuing his studies at Wageningen, Holland, in 1937, on virus yellows of beet [*R.A.M.*, xv, p. 548; cf. also xviii, p. 226], the writer found that a single individual of the peach aphid (*Myzus persicae*) suffices to transmit the disease from an infected to a healthy plant. Viruliferous insects retain their infective capacity after a three days' sojourn on healthy plants. *Macrosiphum solanifolii* was also shown to act as a vector of the disease. The virus is not transmissible from yellowed to sound plants by mere root contact, and all attempts to communicate it directly by means of juice transference gave negative results; in one out of five tests, however, aphids artificially contaminated with the juice conveyed the disease to a healthy beet. Viruliferous aphids do not transmit the infective principle of yellows to their progeny. Certain varieties of fodder beets containing a high proportion of anthocyanin, e.g., Half Sugar Red Giant Claudia, were found to react to infection by the yellows virus by reddening of the foliage.

Experimental evidence is adduced that the externally very similar potato leaf roll and beet yellows are distinct, that the President potato is not a host of beet yellows, nor do beets harbour the leaf roll virus. On the other hand, the transference of *Myzus persicae* from infected beets to spinach and reciprocally gave positive results. The features of the disease on spinach include foliar chlorosis, necrosis of the interveinal tissues of the older leaves, gummosis of the secondary phloem, and heavy accumulations of starch. The characteristic symptoms of yellows only develop in beets receiving a complete fertilizer and provided with a sufficiency of water.

Control measures against yellows were recommended in a previous paper by the writer and others [ibid., xviii, p. 79]. Attention is here further drawn to the necessity of a plentiful, though not excessive, supply of nitrogen to balance the potash and phosphorus of the fertilizer.

BLAIR (W. S.) & LEEFE (J. S.). **Influence of lime in crop rotation with a note on the occurrence of boron deficiency in Mangels.**—*Sci. Agric.*, xix, 5, pp. 330–343, 1939.

In this paper it is stated that when potatoes were grown in western Nova Scotia in soil given different fertilizer treatments as well as an application of ground limestone at the rate of 2 tons per acre, the mean increase in yield in the limed plots over those not receiving lime amounted to 18·9 bush. per acre, but the incidence of scab [*Actinomyces scabies*: see above, p. 412] in the former was so great that the crop was unmarketable. Potatoes were not grown in the same plots until nine years later, when the incidence of scab was again high, though no further application of lime had been made in the intervening period.

Mangolds grown in limed and unlimed plots given (*a*) sodium borate

(10 lb. per acre), (*b*) nitrate of soda, superphosphate, slag, and potash, (*c*) magnesium sulphate (120 lb. per acre), and (*d*) copper sulphate (15 lb. per acre) showed, respectively, 2 and 0, 89 and 81, 85 and 73, and 89 and 77 per cent. heart rot (boron deficiency with *Phoma betae* as a secondary pathogen) and yields of (*a*) 926·8 and 409, (*b*) 265·4 and 185·1, (*c*) 280·7 and 297·6, and (*d*) 256·5 and 200·8 bush. per acre. The disease was almost eliminated by the small amount of boron applied, and while it was usually more severe in limed than in unlimed areas, provided the boron requirement was met, liming increased the yield.

WADE (B. L.) & ZAUMEYER (W. J.). **U.S. No. 5 Refugee, a new mosaic-resistant Refugee Bean.**—*Circ. U.S. Dep. Agric.* 500, 11 pp., 2 figs., 1938.

Extensive tests with the U.S. No. 5 Refugee bean, introduced in 1935, confirm that it is immune from common bean mosaic [*R.A.M.*, xviii, p. 289], besides possessing other desirable qualities [which are discussed in detail].

HEMMI (T.) & NIWA (S.). **On Botrytis rots of stored Onions.**—*Ann. phytopath. Soc. Japan*, viii, 4, pp. 309–326, 1 pl., 1 fig., 1939. [Japanese, with English summary.]

A full account is given of three very rare diseases of stored onions in Japan, mycelial neck rot (*Botrytis byssoidea*) [*R.A.M.*, xvii, p. 789], small sclerotial neck rot (*B. squamosa*) [loc. cit.], and a new disease caused by an undetermined species of *Botrytis*. All three were repeatedly reproduced by experimental inoculations through needle wounds.

Infection by *B. byssoidea* appeared to occur at all temperatures from 3° to 32° C., decay being most rapid at 10° to 24°. Even under the most favourable conditions the decay caused by *B. squamosa* proceeded much more slowly than that due to the other two organisms. The pathogenicity of the undetermined species was such that penetration of the unbroken cuticle of the succulent scales sometimes occurred; decay appeared to be most rapid at about 24°. Inoculations through needle wounds with conidia and conidiophores demonstrated conclusively that all the strains of *B. cinerea* isolated from strawberries, Satsuma oranges, and lettuces were able to infect the succulent scales of stored onions.

YARWOOD (C. E.). **Botrytis infection of Onion leaves and seed stalks.**—*Plant Dis. Reptr*, xxii, 21, pp. 428–429, 1938. [Mimeographed.]

During the past three years onion leaves and seed stalks in the San Francisco Bay region of California have been observed to bear oval, whitish or greyish, sterile lesions 1 to 10 mm. long, though on dead material spores of *Botrytis cinerea* were observed. Inoculations on greenhouse onions with either the latter or spores from pure cultures of *B. cinerea* from orchids resulted in three days in a white foliar spotting similar to that occurring on field plants [cf. preceding abstract]; in severe cases the lesions merged and caused wilting and finally the death of the leaves from the tip downwards. This onion disease would thus appear to bear a fundamental resemblance to the chocolate spot of broad beans (variously attributed to *B. cinerea* or *B. fabae* [ibid.,

xviii, pp. 646, 787]) and the recently described spotting of tomato fruits by *B. cinerea* [ibid., xvii, p. 633]. *B. allii* [ibid., xvii, p. 789], forming whitish, necrotic lesions all round the seed stalks, was prevalent in 1938 in the Santa Rosa district, causing an average of 16 per cent. infection in four fields and heavy losses of seed.

WEISE (R.). **Über die durch Fusarium culmorum (W.G.Sm.) Sacc. hervorgerufene Spargelfusskrankheit.** [On the foot rot of Asparagus caused by *Fusarium culmorum* (W.G.Sm.) Sacc.]—*Z. PflKrankh.*, xlix, 1, pp. 15–40, 1 fig., 3 graphs, 1939.

In 1937 foot rot of asparagus caused by *Fusarium culmorum* [*R.A.M.*, xvi, p. 364] is stated to have attacked 5 per cent. of all stands in Saxony, and up to 26 per cent. in one plantation at Weinböhla. The disease first appears in June or July and affects the older plants, young plants and wild stocks being attacked only following insect or other injury. The disease takes three different forms. In the first and most common, occurring in hot and dry weather, the stem is attacked from 10 to 15 cm. below soil-level and becomes pulpy and carmine-red, the green parts of the plant turning yellow and dying off. In the second form, occurring in wet weather, the stem is attacked at soil-level, the epidermis of the aerial portions gradually turns blackish-green or dark brown, and small, pink pustules develop within the stem, which becomes carmine-red and pulpy inside; the green parts of the plant turn yellow and die off. In the third, chronic form, the plants are attacked at the roots and the stems become carmine-red and pulpy at the base.

The green parts of the plant were found to remain free from the parasite, whereas masses of hyphae and spores could be detected inside the lower part of the stem. The hyphae spread normally in the vessels to about 30 cm. below and 50 cm. above the point of infection.

The fungus excreted in culture a substance toxic to asparagus, producing the same discoloration of the latter as in diseased plants and apparently being responsible for their death. This substance was not, however, toxic to oats. In pure culture *F. culmorum* grew rapidly over a range of $P_H$ values from 3·2 to 8·4, and was indifferent to light. In confirmation of De Haan's results [ibid., xvi, p. 806] the optimum temperature for growth was found to lie between 20° and 25° C. In artificial infection experiments all wounded plants were attacked by the fungus and showed the usual symptoms of the disease, whereas only a small percentage of the uninjured plants became infected and in these a slight wound was usually afterwards discovered to be present. In most cases the fungus entered the plant through the stem and not the root.

Soil samples from the Weinböhla district showed the universal presence of *F. culmorum* at all depths. The fungus can survive as a saprophyte on dead asparagus tissue, in the upper layers of new compost piles, and in straw. Comparative measurements of soil humidity and temperature showed that conditions favourable to its development (a temperature of 20° to 27° and sufficient humidity), occur inside the asparagus beds during dry, hot weather, and at the surface during wet summer weather or in the autumn. When the mounds, formed by earthing-up, and usually left intact at Weinböhla till the end of summer,

were removed in alternate rows directly after cutting, infection was reduced from an average of 4·4 to 7·2 per cent. to one of 1·0 to 1·7. The removal of the mounds directly after cutting is therefore recommended, especially as it would entail no appreciable additional expense. Soil disinfection is believed to be too costly and difficult to apply. Dead and infected plant remains and stubble should be carefully removed and burnt in order to prevent the formation of spores. A sufficient supply of potassium, phosphorus, and particularly humus should be ensured. So far all varieties of asparagus have been found to be equally susceptible to the fungus.

PAUL (W. R. C.) & FERNANDO (M.). **The effect of manuring on the incidence of Chilli leaf curl.**—*Trop. Agriculturist*, xcii, 1, pp. 23–28, 1 fig., 1939.

In the dry zone of Ceylon, pepper (*Capsicum frutescens*) is widely affected by a form of leaf curl differing from that recently reported by Park and Fernando [*R.A.M.*, xviii, p. 273], characterized by the adaxial curling of the leaves, and by a buckling of the interveinal areas due to the inability of the veins to keep pace with the extension of the leaf surface. The affected leaves remain small and the fruits are malformed. The internodes fail to reach their maximum length and the plants appear bushy. The disease is not caused by a deficiency of the soil in nitrogen and organic matter and may possibly be due to insect injury or a virus.

**Amtliche Pflanzenschutzbestimmungen.** [Official plant protection regulations.]—*Beil. NachrBl. dtsch. PflSchDienst*, xi, 1, pp. 24–38, 45–47, 1939.

JAPAN. The Japanese quarantine regulations, promulgated on 25th March, 1914, and here amended and brought up to date (1938), prohibit the importation of sugar-cane and parts thereof (including seeds) from Taiwan (Formosa), the South Sea Islands, and all foreign countries in order to prevent the introduction of downy mildew or Australian leaf stripe (*Sclerospora sacchari*), and of Solanaceae or parts thereof (including fresh fruits and tubers) with a view to the exclusion of wart disease (*Synchytrium endobioticum*).

RUMANIA. A list, dated 3rd March, 1938, is given of 41 fungal, bacterial, and virus diseases regarded as constituting a danger to cultivated crops and henceforth to be the subject of special prophylactic measures.

**Legislative and administrative measures.**—*Int. Bull. Pl. Prot.*, xiii, 2, pp. 29M–30M, 1939.

GERMANY (PRUSSIA). By a decree dated 31st October, 1938, and dealing with potato virus diseases, the planting of peach and apricot trees is forbidden in certain parts of Pomerania. Further, peach and apricot trees must be watched for the appearance of *Myzus persicae* and those which, in spite of obligatory treatment with carbolineum become infected, must be sprayed immediately before or after flowering with a preparation recognized as efficacious by the central plant protection service [*R.A.M.*, xviii, p. 133].